Austroads

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Bicycle Parking Facilities: Guidelines for Design and Installation

Bicycle Parking Facilities: Guidelines for Design and Installation

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Abstract

This report provides information to assists in the design and installation of bicycle parking and end-of-trip facilities that are fit for purpose. The report provides recommendations, principles and examples of best-practice facility design. It also highlights common mistakes and suggests ways to improve flawed designs.

The report expands on and complements information that is provided in the Australian Bicycle Parking Standard AS2980.3 and in the Austroads *Guide to Traffic Management Part 11: Parking*.

Keywords

Bicycle parking facilities, locker, cage, rack, rail, shower

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About Austroads

Austroads is the peak organisation of Australasian road transport and traffic agencies.

Austroads' purpose is to support our member organisations to deliver an improved Australasian road transport network. To succeed in this task, we undertake leading-edge road and transport research which underpins our input to policy development and published guidance on the design, construction and management of the road network and its associated infrastructure.

Austroads provides a collective approach that delivers value for money, encourages shared knowledge and drives consistency for road users.

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- Roads and Maritime Services New South Wales
- Roads Corporation Victoria
- Queensland Department of Transport and Main Roads
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Transport Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Australian Government Department of Infrastructure and Regional Development
- Australian Local Government Association
- New Zealand Transport Agency.

Summary

In the same way that the availability and usability of car parking is an important requirement for motor vehicle use, the availability and usability of bicycle parking is critical to the viability of the bicycle as a mode of transport. By providing bicycle parking in accordance with the principles outlined in this report, bicycle use can be encouraged and high-value urban space can be utilised efficiently.

This report provides information that assists in the design and installation of bicycle parking facilities and end-of-trip facilities that are fit for purpose. The report provides recommendations and principles that should be followed as well as examples of best-practice facility design. The report also highlights common mistakes and suggests ways to improve such flawed designs.

This report provides information that allows owners, managers, designers and installers to:

- understand the benefits of installing bicycle parking
- consider special issues that apply to the provision of bicycle parking for various applications
- gain familiarity with the various product types on the market and how they may be utilised
- assess and meet bicycle parking demand over the lifespan of a bicycle parking installation
- choose the appropriate location for bicycle parking
- design appropriate access to the bicycle parking facility
- plan and design the internal layout of a bicycle parking facility to provide easy and safe access to bicycles
- plan and design the surrounding building features such as walls, floors, corridors and lighting
- plan and design end-of-trip facilities such as showers, lockers and change facilities
- operate the facility on a day-to-day basis.

This report should be read in conjunction with the Australian Standard for Bicycle Parking (AS2890.3) which provides detailed information on certain aspects of bicycle parking, such as the geometric spacing that is required to provide adequate clearance for access to bicycles during the parking process.

This report extends the information provided in the Austroads *Guide to Traffic Management Part 11: Parking*, which provides guidance on parking provision rates and other jurisdictional guidance.

Contents

Tables

Figures

1. Introduction

Bicycle parking is an important part of developing infrastructure to support the use of bicycles, particularly for transport purposes.

1.1 Overview

More and more people are choosing to use the bicycle as a general means of transport. Interest is particularly strong over short trips and in areas where competing modes of transport are expensive, congested, inefficient and/or unreliable. This increase in bicycle use increases the demand for bicycle parking and related end-of-trip facilities. When executed well, bicycle parking investment not only meets current demand, but can also stimulate an increase in cycling use.

“Push-factors” such as traffic congestion, road tolls, parking fees and crowded public transport drive people to consider alternative means of transport. As such, transport agencies and local governments are seeing the benefits that cycling can have for the community and have started to take steps to encourage bicycle use.

New bicycle infrastructure is creating a safer and more efficient environment that acts as a “pull-factor” to encourage bicycle use. Pull-factors for cycling includes high quality cycling route, bicycle parking, and other end-of-trip facilities such as shower and change facilities and lockers.

Employers and building developers are seeing the benefits that promoting bicycle use offers to their business. They are responding to increased demand for bicycle parking from tenants and are, in some cases, driving the demand through favourable policies and high-quality infrastructure.

Individuals are recognising that cycling provides them with many benefits and have been increasingly taking to the bicycle for non-leisure based trips such as traveling to work, the shops or to local services.

The role of a Bicycle Parking Facility is to support the use of the bicycle by providing a secure and high amenity location to store the bicycle on arrival. Bicycle Parking Facilities will support the use of the bicycle by removing one of the barriers to uptake, but still needs to be supported by a high quality and safe bicycle network.

In countries with a comprehensive approach to encouraging cycling, such as The Netherlands and Denmark, it is not unusual for one third of trips to be made by bicycle. There are a huge number of benefits to capture by achieving a similar level of bicycle use in Australia.

This Report expands on the material provided in the Australian Standard on Bicycle Parking (AS2890.3) and the Austroads Guide to Traffic Management (Part 11: Parking). The Report communicates the concepts and principles that are behind the successful investment in Bicycle Parking Facilities, and those that have commonly been neglected in some way in facilities that fall short of their aims.

Principles are provided to aid in the design of successful Bicycle Parking Facilities that will meet the needs of all users. The principles aim to be general, so they can be applied to a wide variety of conditions, which will each have their own unique characteristics. With a strong grasp of the concepts in this document and with reference to the Australian Standard and the Austroads Guide, it is fairly straightforward to provide successful Bicycle Parking Facilities.

Figure 1: Traffic congestion is a push-factor that encourages cycling participation

Figure 2: Safe bicycle networks are a "pull-factor" that encourage cycling participation

1.2 Definitions

Accessories	Bags and other items that the user may take with them when they park their bicycle, such as speedometer, lights or water.
Aisle	The space through which the users move between rows of bicycles or other objects to lock up and leave their bicycles.
Amenities	Any service that supports a *Bicycle Parking Facility* such as showers and lockers.
Approach	The route between the Bicycle Network and the Bicycle Parking Facility.
Australian Standard	The Australian Standard referred to throughout this Report is the Australian Standard for Bicycle Parking (AS2890.3).
Bicycle Cage	An enclosure for several bicycles that can usually be locked.
Bicycle Corral	A group of *Bicycle Racks*, usually on a *Kerb Extension* or in a car parking space.
Bicycle Spacing Envelope	The limits of the three-dimensional space (length, width, height) taken up by a typical adult bicycle as defined on p.5 of this Report.
Bicycle Locker	An enclosure that can be locked and usually houses one bicycle.
Bicycle Network	The local network of paths, roads and other bicycle infrastructure that supports cyclists accessing their various trip destinations and *Bicycle Parking Facilities*.
Bicycle Parking Facility	Objects that are designed, built and installed in order to enable people to park bicycles or manage end-of-trip needs.
Bicycle Rack	A fixture, usually metal, that provides an anchor that is used to attach a bicycle via a *Locking Mechanism*.
Centre Spacing	The distance from one *Bicycle Rack* to an adjacent one.
Double-Deck Bicycle Rack	A *Bicycle Rack* that has two vertical levels of parking, with one horizontal system on the ground and the other above it.
Floor-Mounted Bicycle Rack	A *Bicycle Rack* in which one or more of the parked bicycle's wheels are on the ground.
Footprint	The floor space that a *Bicycle Parking Facility* occupies.
Formal Parking	A manner of parking a bicycle that uses a purpose-built *Bicycle Parking Facility*.
Informal Parking	A manner of parking a bicycle that does not use a purpose-built *Bicycle Parking Facility*.
Inline Parking	This parking configuration is achieved when *Floor-Mounted Racks* are installed one after another in rows with each rack parallel / angles as per the last.
Layout	The formation of Bicycle Racks within a Bicycle Parking Facility.
Kerb Extension	An area that extends the footpath into the road space through the use of kerbing.
Locking Mechanism	A chain, cable, bracket or other device that can secure a bicycle to a *Bicycle Rack,* or can immobilise a bicycle. See p.7 for details.
Locking Zone	The area near the bicycle frame and wheels where the user locks their bicycle. See p.8 for details.
Packing	Storing a number of bicycles in a highly space-efficient manner by partially disassembling the bicycles.
Passive Surveillance	The security provided by the presence of people in a space.
Rack Module	A *Bicycle Rack* that caters for more than two bicycles.
Rack Unit	A *Bicycle Rack* that parks one or two bicycles.
Safety Bicycle	The bicycle design that first used a chain to drive the rear wheels and removed the need for a large drive wheel, such as a penny-farthing.
Standard Bicycle	This bicycle is defined in AS/NZS 1927:2010 and has particular characteristics as defined on p.6 of this Report.
Setback	The distance between the front or rear of a parked bicycle and a wall or corridor.
Stacking	Storing a number of bicycles in a space-efficient manner without disassembling them.
Temporary Bicycle Racks	A *Bicycle Parking Facility* that is used temporarily (but not permanently installed) to meet a temporary bicycle parking demand.
Travel Plan	A plan that is developed to provide guidance for how to access a particular site.
Wall-Mounted Bicycle Rack	A *Bicycle Rack* in which the bicycle hangs from a rack that is mounted on a wall.

1.3 Bicycles

1.3.1 Standard Bicycles

The vast majority of adult bicycles sold in Australia today are based on the shape of the Safety Bicycle, which first appeared in the late 1800s. Some basic variations on this shape include: the racing bicycle, the mountain bicycle and the Dutch bicycle. It is fundamental that Bicycle Parking Facilities accommodate these standard bicycles that are described in more detail below.

Racing bicycles often have “drop handlebars” that extend in front and below the stem that attaches the handlebar to the rest of the bicycle. The total width of the handlebars is generally less than handlebars on other types of bicycles. Racing bicycles are typically lighter than other bicycles, making them easier to lift up if the bicycle is being stored on Wall-Mounted Racks. The tyres on many racing bicycles will often be only 23mm wide (some are wider), which means that they tend to fit very loosely in Bicycle Racks designed to cradle the wheel, and expensive components can easily be buckled. For the purpose of bicycle parking, a ‘racing bicycle’ is stated to generally include road bicycles (i.e. geared bicycles), track bicycles (or fixed gear bicycles), touring bicycles and single speed bicycles as they feature a similar geometry.

Mountain bikes have robust frames, thick tyres (around 40-50mm wide) and may have front and/or rear suspension. The handlebars are general fairly straight and are usually wider than handlebars on racing bicycles.

Dutch bicycles (also referred to as a ‘step-through’ frame or a ‘mixte’) have handlebars that sweep back towards the rider and allow the rider to sit more upright than on racing bicycles or mountain bikes. The geometry usually allows the user to easily get on and off the bicycle by stepping through the frame. These bicycles are commonly fitted with pannier racks.

Figure 3: A road bicycle

Figure 4: A mountain bicycle

Figure 5: A Dutch bicycle

1.3.2 Non-Standard Bicycles

While the shape of the *Standard Bicycle* has changed little, there are many other types of bicycle available on the market with quite different shapes. Recumbents, cargo bicycles and tandems are just a few examples of the many different shapes available. In recent years, folding bicycles have also become prevalent, which enable users to make their bicycle more compact for parking, as well as travel more easily on public transport.

Due to the relatively-minor market share of these styles of bicycle in Australia, there is little need to provide dedicated parking for every style. A better solution is to ensure that there are *Floor-Mounted Racks* in every *Bicycle Parking Facility*, as these tend to provide a versatile solution for most types of bicycle.

The size and shape of a variety of bicycles is documented in the *Australian Standard*.

Figure 6: A child's bicycle

Figure 7: A cargo bicycle

Figure 8: A recumbent bicycle

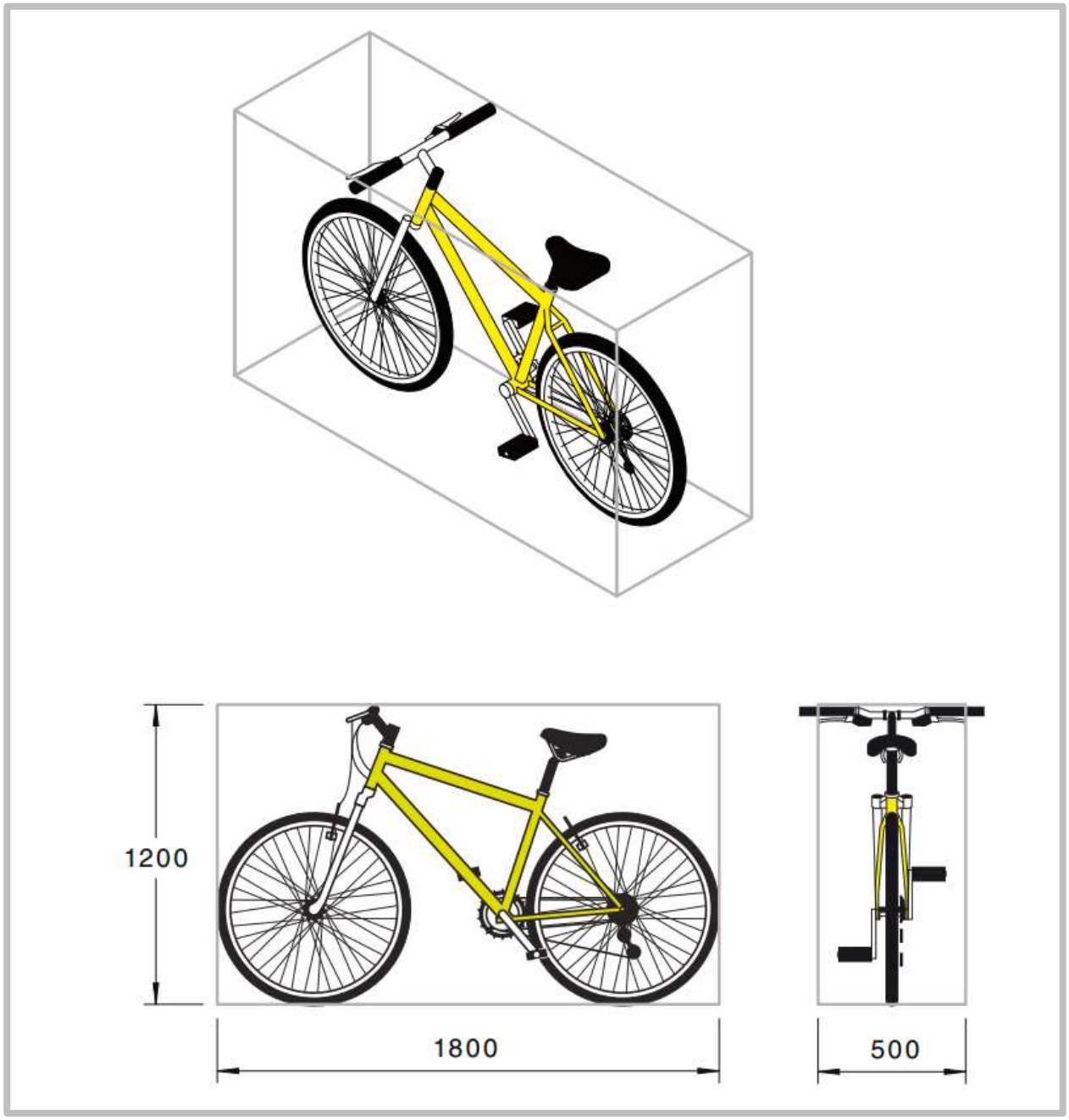
Figure 9: A tandem bicycle

1.3.3 The Bicycle Spacing Envelope

Adult bicycles are usually close to the same length, but tend to vary in height (proportionally with the height of the rider). Shorter people ride lower bicycles and taller people ride higher bicycles. Some bicycles have bigger or smaller wheels. Some bicycles have wider or narrower tyres. Some bicycles have wide handlebars that stick out sideways while others have narrower ones that curve down. Some have a top bar on the frame and some do not.

For the purpose of design, the Australian Standard for bicycle parking (AS2890.3) provides the *Bicycle Spacing Envelope* as shown in Figure 10. It should be noted that the width of the bicycle parking envelope is designed to indicate the space required around the frame to allow access for a person to park and lock the bicycle. This width does not indicate the maximum width of the handlebars of all bicycles.

Figure 10: The bicycle spacing envelope



Source: AS2890.3:2015

1.4 Locking

1.4.1 Wheel Locks

Wheel Locks immobilise the bicycle by preventing the wheel from turning but they do not stop the bicycle from being picked up and moved. This type of lock is common in Northern Europe but less common in Australia. This report recommends that *Bicycle Parking Facilities* always provide *Bicycle Racks* to allow the user to secure the bicycle to an immovable fixture rather than rely on the use of a *Wheel Lock*.

Figure 11: This wheel lock inserts a metal bar between the spokes

1.4.2 Removable Locking Devices

In Australia users typically carry their own lock(s), such as a D-lock, flexible chain or flexible cable. Below are some typical examples of removable locking devices. The D-lock and flexible cable can be seen in-use in Figure 14.

Figure 12: D-lock

Figure 13: Flexible cable

1.4.3 Locking Zone

Bicycle Racks should be designed to allow the user to easily lock the three main components of the bicycle: the frame, the front wheel and the rear wheel. It is therefore important that the *Bicycle Rack* and the *Layout* provides enough space for the user to reach these areas easily. Some users will only choose to lock the frame.

Figure 14: This simple 'U-rail' allows the frame and both wheels to be secured

Figure 15: Failing to lock the frame can be a big mistake

1.5 Security Levels

Bicycle Parking Facilities fall into three categories of security: A to C, as shown in the below table, with Level A being the highest and Level C being the lowest. It should be noted that security levels do not, in isolation, determine the standard of facility to be designed. This should consider all factors, including user friendliness, convenience, cost, aesthetics and durability.

Table 1: Bicycle parking security levels

Security Level	Style	Suitable for:
A	Bicycle Locker	Long-term parking that includes overnight storage or public transport hubs
B	Bicycle Cage	Day parking for staff, students, residents and public transport users.
C	Bicycle Rack	Short-term parking such as visitor or customer parking, either on or off-street.

1.5.1 Bicycle Lockers (Level A Parking)

Bicycle Lockers are individual compartments used to store and separately lock a bicycle. *They* offer the highest level of security (Level A) and are suitable for applications where bicycles are stored overnight or over long periods of time. People with expensive bicycles may favour *Bicycle Lockers.*

Cases where *Bicycle Lockers* may be suitable include:

- Apartment complexes.
- Holiday apartments where bicycles are stored long-term.

The functionality of a *Bicycle Locker* may also be provided in residential settings through an on-title, general-purpose storage space. Care must be taken to ensure that this space and the *Approach* are designed for suitable access by bicycle.

The use of general storage areas / cages for bicycle parking is accepted by some Australian planning authorities if provided over and above the general requirements. This option is cautioned, unless good levels of access are able to be achieved.

Although *Bicycle Lockers* provide the highest level of security, they have a number of disadvantages compared to *Bicycle Cages* such as:

These include:

- High construction cost per unit.
- High maintenance and administration costs.
- Large footprint per unit.
- Lockers only serve one person and are not available to others when that person is not using the locker.
- Lockers are sometimes used to store private belongings other than bicycles.
- It is difficult to assess the usage of lockers.

Figure 16: These lockers at a train station are able to be easily used

Figure 17: These lockers are provided to residents for overnight storage

1.5.2 Bicycle Cages (Level B Parking)

A *Bicycle Cage* is a restricted-access enclosure designed to store a number of bicycles and provide additional security and shelter above that afforded by standard *Bicycle Racks* alone. Bicycle parking provided within a secure indoor car parking area is also included under the definition of a Bicycle Cage. *Bicycle Cages* include *Bicycle Racks* which are placed either on the floor, walls or purpose built frame within the *Bicycle Cage*. *Bicycle Cages* can be designed in modular sections, which allows the 'cage' to be expanded as usage rises.

The cost of constructing a *Bicycle Cage* is significantly higher than the cost of using open-air *Bicycle Racks*, however the additional security and shelter is highly sought-after and increases the attractiveness of using the bicycle as a transport mode.

Although the level of security provided by a *Bicycle Cage* is lower than that provided by a *Bicycle Locker*, there are a number of advantages to providing *Bicycle Cages,* such a*s:*

- Better utilisation of space – More than 20 bicycles can be parked in the space required for three car spaces. This same space would park six or possibly eight bicycles in *Bicycle Lockers*.
- More flexible access - Because not everyone uses the cage all the time, the number of people with access can be greater than the number of available spaces.
- More cost-effective – *Bicycle Cages* spread the cost of providing security and weather protection across all the users.
- Simpler to administrate – Due to the private nature of *Bicycle Lockers*, underutilisation goes unreported. *Bicycle Cages* are transparent and always accessible.

TransPerth utilises *Bicycle Racks*, *Bicycle Cages* and *Bicycle Lockers*. All new capacity is provided through the installation of *Bicycle Cages*. Unused *Bicycle Lockers* are removed, stored and re-installed where there is demand.

Public Transport Victoria has shifted from using *Bicycle Lockers* to using *Bicycle Cages* supported by open-air *Bicycle Racks*. In 2012, they began to remove *Bicycle Lockers* and replace them with *Bicycle Cages*. No *Bicycle Lockers* are being re-installed in Victoria.

Queensland and the ACT have installed *Bicycle Cages* to complement *Bicycle Lockers* and open air *Bicycle Racks*.

Interestingly, in many locations the level of *Informal Parking* has been observed to rise around a *Bicycle Cage* once it has been installed.

Figure 18: This facility includes a mix of floor and wall-mounted racks

Figure 19: This bicycle cage has an access system that is integrated with the train ticketing system

1.5.3 Bicycle Racks (Level C Parking)

Bicycle Racks are permanently-installed fixtures (usually metal) that are designed to provide a structure to support the bicycle and provide points to secure the bicycle with a separate lock. Effective *Bicycle Racks* come in many shapes and sizes. Some park the bicycles on the ground and some hang the bicycles vertically against a wall or frame.

Bicycle Racks can be installed in a variety of locations, including footpaths, inside *Bicycle Cages*, in basement car parks or on private property. When they are installed in standalone applications where passive surveillance is good, they are suitable for short-stay parking (<3 hours). If they are installed with additional security, such as within a secure basement carpark or inside a *Bicycle Cage*, they are generally suitable for longer-term parking.

For greater detail on *Bicycle Racks* see p.43.

Figure 20: A typical pole-mounted bicycle rack installed on a retail strip

Figure 21: These bicycle racks are installed next to the Sydney Town Hall

Figure 22: This bicycle parking facility uses popular and effective U-rail bicycle racks

1.6 Other Approaches to Parking and Storage

This Guide is mainly concerned with the implementation of *Bicycle Parking Facilities* that utilise one of the styles mentioned earlier: *Bicycle Lockers*, *Bicycle Cages* and *Bicycle Racks*. There are other ways that bicycles are stored or parked that are useful in different circumstances and these will be briefly covered here.

1.6.1 Informal Parking

Informal Parking can be provided by any structure that has a primary purpose other than bicycle parking but which can be used as a *Bicycle Rack*. For example, poles and fences can often be used as makeshift *Bicycle Racks* where this use is permitted, particularly when close to an intended destination.

It is always preferable to provide dedicated Bicycle Parking, rather than relying upon street infrastructure, which may not suitably support backs and cause damage to them when they fall over, block adjacent walk ways. However, where sufficient space exists and until such time that formal parking facilities can be provided, informal parking facilities save money and from an urban design point of view, the 'bicycle parking' remains invisible when not in use.

Figure 23: The informal parking on the fence and rail in this location is not appropriate as the access ramp is blocked and the parked bicycles are across the walking area

Figure 24: The fence protects the garden area and provides overflow capacity for the formal facility in the background

Figure 25: The fence restricts pedestrian access to the roadway and provides overflow capacity for the formal bicycle parking facility in the background

1.6.2 Temporary Bicycle Racks

Temporary Bicycle Racks are not suitable for permanent, public bicycle parking applications.

Rather than permanently installing *Bicycle Parking Facilities*, venue operators or event managers can use *Temporary Bicycle Racks* to cater for high-demand periods or special events. This type of *Bicycle Parking Facility* is often run as a cloakroom-style system or "valet bicycle parking", which matches the bicycle to its owner to avoid theft.

The keys to temporary parking are:

- No permanent construction or foundations
- Easy transportation of the parts
- Compact storage of the bicycles
- No locking of bicycles
- Staffed supervision
- Needs proof of ownership to avoid theft.

An effective way to provide temporary parking is to use triathlon style parking frames, similar to that shown in Figure 26. The frames are easily transported, assembled and disassembled. The triangular legs allow the frames to work successfully on uneven ground and can easily be configured into rows to allow for easy access. Also, through the use of temporary fencing, an increased level of security can be achieved.

Figure 26: This special event parking uses triathlon style bicycle parking frames

This method is typically only suitable when bicycles do not need to be locked. The bicycles are relatively easy to park, although this is often done by an attendant rather than the user. These systems support the saddle and are difficult to use when the bicycle has a child's seat or the saddle is close to the frame. Generally, these anomalies can be managed by the supervising staff.

Triathlon style frames are not appropriate in situations where there is no supervision of the *Bicycle Parking Facility*. The parking shown below at the café is an example of a poor use of triathlon style frames. This example also demonstrates a number of other mistakes such as placing parking on a slope with a surface that is likely to be uneven and slippery when wet.

Figure 27: An example where a triathlon style frame is a poor solution

The Museum of Old and New Art (MONA) in Hobart regularly provides patrons with valet bicycle parking. Other Hobart events with valet parking include Taste of Tasmania, Sustainable Living Expo and Treadlightly Festival.

A valet parking operator in Melbourne reported 878 bicycles parked at the Sustainable Living Festival over a number of days. At this level of use, bicycle parking starts to become significant. It would take a standard suburban train or nine buses to move this many people.

A Sydney group offers their services to festivals, outdoor cinemas, community gatherings, street parties, sporting events, environmental events or rallies, exhibition openings, arts, music and cultural events, markets, launches or any occasion that brings people together.

1.6.3 Domestic Bicycle Racks

Domestic Bicycle Racks are not suitable for permanent, public bicycle parking applications.

Some types of *Bicycle Racks* do not allow the user to secure the frame and both wheels using a bicycle lock. These systems can therefore only be used when the bicycles do not need to be locked, such as in private residential applications.

There are many worthwhile domestic *Bicycle Racks* that do not allow the bicycle to be locked. Some are as simple as a hook to hold the front wheel. Domestic systems are outside the scope of this report as they are not suitable for public parking.

For example, the rack shown in Figure 28 provides metal loops that could be used by a cable lock; however it is difficult to lock the frame of a bicycle to this rack using a D-lock.

Figure 28: Domestic wall mounted bicycle racks

Wall-Mounted Racks for Horizontal Storage

Some *Wall-Mounted Racks* allow for the bicycle to be hung sideways against the wall as in Figure 29. These systems are often used above the bonnet of a car in an apartment carpark, but can be used on any wall, as long as they are suitably spaced.

These storage systems meet many of the principles of bicycle parking, but are not suitable for public *Bicycle Parking Facilities* as they:

- need to be allocated to the same user as the parking space
- do not allow for large numbers of bicycles to be stored efficiently.
- are sometimes difficult to access when parking spaces are occupied, and require some strength to lift the bicycle.
- do not work well with compact frames, frames without a horizontal top tube, or when equipment such as locks and bottles are attached to the frame.

Figure 29: Domestic wall-mounted bicycle racks

2. Why Install Bicycle Parking?

Bicycle parking generates benefits for users and for workplaces, landlords, government and the community. This report focuses on the benefits accrued by the provider of the parking to help justify their expenditure.

2.1 Increased Trade / Customers

Retailers are rightly concerned about how their customers access their business and often resist the removal of nearby car parking. For most businesses, however, bicycle parking provides better returns for a given space.

In The Netherlands the link between bicycles and retail success is well understood. The frequency-of-response chart shows that the strongest association with the word 'bicycle' is local grocery shopping.

Figure 30: Word-association chart for "bicycle" in the Netherlands.

While some businesses won't tend to attract bicycle traffic, many businesses (even some unexpected ones) can benefit from easy access by bicycle. While service stations provide petrol for cars (a product not required by bicycles), they also serve as a corner store which bicycle users will visit. Big-box stores often provide delivery services or even vehicles for rent which help those who come without a car. For many retailers, especially local retailers, customers arriving by bicycle, public transport or on foot accounts for more than half their turnover.

In areas where car travel is time consuming or car parking is expensive, the competitiveness of the non-car modes will increase. The increased catchment area offered by the bicycle over walking alone (around 15 times) makes the bicycle the perfect choice for local shopping trips.

A study of five shopping strips in the City of Yarra showed that the majority of shoppers were local residents who were most likely to walk (68 per cent) and least likely to drive (16 per cent) to get to the shopping strip. A similar study in Acland Street found that half the customers walked.

Studies show that customers who walk or ride spend less each visit. The City of Yarra study found that locally based shoppers spent less on average per visit ($20) than other visitors ($50). A study in the City of Melbourne found that customers arriving at a shopping centre by bicycle spent a quarter less than those who came by car.

However, these studies show that the walkers and riders visit more often than the customers who come by car and so are more valuable overall. The Acland Street study found that local walking customers accounted for 86% of their revenue. As a result, the traders asked the Council to remove nine car spaces and widen the footpaths.

A study of a shopping centre in Lygon Street Carlton where two car parks were converted to bicycle parking showed that twelve bicycle riders spend more than two car drivers. Changing one car space to a facility for six bicycles generated 3.6 times more expenditure in local businesses.

This study showed that two fully-occupied car spaces generated $156 per hour. Twelve bicycle spaces with four bicycles parked generated more than $156 an hour. Fully occupied, the bicycle spaces generated $565 an hour. At times up to fifty bicycles are parked in an area with formal parking for two dozen bicycles.

Popular bicycle corrals (as shown in the example in Lygon Street in Figure 31) make the local shopper visible to the store owner and the community, advertising the idea and increasing participation. In Portland Oregon the local traders understand the link and there is a queue of more than fifty local businesses that wish to convert car parking outside their store into bicycle parking.

Figure 31: A heavily-used bicycle corral in Lygon St Victoria.

2.2 Efficient Use of Space

Poor space-utilisation results in a number of unnecessary costs such as the need to purchase additional land, construct additional buildings and maintain additional facilities. Well utilised bicycle parking is an efficient use of space with around 10 bicycle parking spaces taking up the same footprint as one car parking space.

The economic savings can be significant, especially in areas where land values are high. In addition to land costs, the cost of constructing a basic car parking space is at least $10,000 with underground and multi-level car parking structures more expensive again[1]. The cost of hiring a car space in a CBD area can be $5,000 to $10,000 per year.

Governments sometimes seek to discourage the construction of car parking in high-density areas through the use of parking minimisation policies or car parking levies/taxes. These car parking levies can add significantly to the cost of a car space. Regulations in the ACT allow a small offset in the number of car parking spaces in return for bicycle parking provision. This offset has a value significantly higher than the cost of providing the bicycle parking.

While bicycle parking is useful for commuters, it can also provide an organisation with a secure storage area for a fleet of bicycles that can be used instead of taxis or as part of a larger vehicle fleet.

Space that is freed by a mode shift from using cars to using bicycles provides additional space for customers, delivery vehicles and higher value uses. A shopping centre whose employees ride to work will have more space available for customer parking or more retail floor area.

All else being equal, the opportunity cost of land devoted to parking indicates that investment in well utilised *Bicycle Parking Facilities* pays dividends. The same arguments can be made for universities, businesses, train stations, residential developments and more.

2.3 Improved Accessibility

Convenient, cheap and efficient access makes places more desirable to visit and can give a competitive advantage over other locations, including in attraction of customers, employees.

2.4 Increased Public Transport Ridership

Successful public transport systems draw customers from a variety of transport modes. Walking to public transport stops typically has a small catchment (up to approximately 1km for rail, but less for tram and bus). Australia has traditionally looked toward motor vehicles to expand this catchment. Multi-modal journeys are often facilitated by free or cheap parking at train stations and buses which feed major transport interchanges. However, catchment expansion can also be achieved through the provision of bicycle parking at train stations combined with a safe and efficient bicycle network. A 1 km walking trip of approximately 10-15 minutes provides a 3 square kilometre catchment. An equivalent 4 km bicycle trip of 10-15 minutes provides a 44 square kilometre catchment.

Rather than encouraging all bicycle users to take their bicycle onto public transport, the user's bicycle can be parked at the source station and then a bike-share bicycle could be available for use at the destination station.

The Dutch have recognised the need to provide an option for bicycle users as they arrive at their destination station and have developed "ride-on-arrival" services with 5,000 bicycles available at more than 240 rail stations. 10% of the train passengers complete their train journey with a bicycle trip.

1 In April 2013 the Queensland Government announced it would build 400 spaces on Council land for $7m – a cost of around $17,500 a space. The 2012 NSW Government car park program will deliver 1,200 carparks for $148m at an average cost of over $100,000 a space.

2.5 Improved Local Community

Encouraging bicycle can activate streets, stimulate social connection and improve passive surveillance in a local community. This may be achieved by making streets more liveable and pleasant for people by reducing the noise, pollution and danger associated with motor vehicles.

Investments made in bicycle parking and local bicycle networks can return benefits to local ratepayers. Shifting trips to bicycle can reduce the need for expansive car parking areas and reduce traffic congestion.

Local communities are often impacted by overspill car parking surrounding a destination or activity centre. A bicycle parking scheme can be part of a travel demand management process to mitigate parking stress and parking intrusion into unwanted areas.

2.6 Smoother Change Management

Bicycle parking can assist in managing a changing work environment such as during construction works or following an office relocation. These events can force people to rethink their travel choices and provide an opportunity to permanently shift behaviour.

2.7 Reduced Risk

In instances where no bicycle parking is provided, there is a risk that bicycles will be parked in corridors, on disability access ramps, in front of fire extinguishers or across fire doors. In this situation, the provision of attractive bicycle parking is a valuable risk mitigation strategy.

2.8 Visible Commitment to Sustainability

The identified sustainability benefits of achieving mode shift to cycling and can be important to businesses that have set sustainability goals or have other related corporate responsibilities.

Bicycle Parking Facilities are a physical sign of commitment to sustainable practices and are a visible sign of sustainability processes which are often not seen. To quantify the success of bicycle parking installations, it is a good idea to record usage levels of car and bicycle parking over time.

2.9 Improved Goodwill

Bicycle parking can stimulate goodwill for a brand or organisation. The benefits that today's user derives from bicycle transport are highly valued and front of mind. Cyclists are likely to look favourably on institutions that support their choice and less favourably on those that do not. Providers can build goodwill or brand advantage through an investment in bicycle parking.

Employers report that they use bicycle parking and associated services as part of their suite of employee attraction and retention programs. One bank says they encourage *"our people to make sustainable choices in their everyday lives and are committed to providing the necessary support and facilities for our people to maintain a healthy lifestyle."* Unlike some other employee benefits, bicycle parking investments can be written off against tax and attract no Fringe Benefits Tax.

2.10 Greater Capital Growth

Developers and owners can increase the value of a building by designing in or retrofitting sought after sustainability measures. Good-quality bicycle parking and end of trip facilities are often a factor which attracts high-value tenants who in turn seek to attract talented staff by providing accessible and pleasant workplaces.

A small but valuable number of points towards Green Star accreditation can easily be earned by providing bicycle parking. A 2011 report by the IPD Property Index found that, over two years, NABERS and Green Star rated assets outperformed non-rated assets.

2.11 Improved Health

Around two thirds of the population fail to do enough physical activity to protect themselves from chronic diseases such as heart disease, some cancers and diabetes. The situation is deteriorating and will result in a massive social and economic burden on the community. Governments are particularly concerned by this trend and have an obligation to manage both the health of the population and the health of the economy. Therefore, governments are encouraging bicycle use through the provision of *Bicycle Parking Facilities* and *Bicycle Networks* which have the potential to provide a population-wide improvement in health outcomes.

Adequate physical activity not only significantly improves health, it also brings other more immediate health benefits such as well-being and alertness. These benefits are particularly important to educational facilities and workplaces that have a keen interest in the performance of their students and employees.

The health value of bicycle parking to employers is mainly in avoided absenteeism. An investment in bicycle parking is similar to a company-sponsored flu vaccination where the company spends money on prevention and recoups the value in avoided lost time costs. Direct cost savings from an investment in bicycle parking can be identified in metrics such as sick days not taken which provides a direct financial benefit to the employer.

Companies incur lost time costs when employees contract chronic diseases such as diabetes or heart disease. Over the longer term, employees who undertake adequate physical activity will have a lower risk of chronic disease. The value of this lost time is beginning to be recognised in Australia by programs such as the Victorian workplace screening program which aims to detect diseases such as diabetes and heart disease at an early stage.

Alongside absenteeism there is also ‘presenteeism’: a term that describes workers who attend work but whose productivity is compromised by a sedentary lifestyle.

A United States assessment[2] of the cost effectiveness of ‘worksite wellness’ found that workplace health programs resulted in an average 25.3% decrease in sick leave absenteeism, 40.7% decrease in workers’ compensation costs, 24.2% decrease in disability management costs and $5.81 saving for every $1 invested in employee wellbeing.

The low cost of bicycle parking as a staff wellness measure are not to be underestimated. Compared to resource-intensive activity programs, bicycle parking has the great advantage of being largely set-and-forget.

2.12 User Benefits

So far, we have focused on the benefits to the providers of bicycle parking because they are the ones who need to be clear what is to be gained through an investment in *Bicycle Parking Facilities*. Now it is time to look at the benefits captured by users.

People ride bicycles for a variety of reasons and derive benefits in a variety of ways, including:

- The un-measurable, non-utilitarian benefit of ‘fun’ is a strong motivator for riders. The importance of this to the individual should not be underestimated. Fun often tops self-reported surveys of reasons for riding.
- The health benefits of riding can be of benefit to providers such as employers, but are also some of the most significant benefits to riders. Although riders often underestimate the medium and long term health benefits of riding, the immediate refreshment benefits of physical activity are front of mind. Riders talk of ‘arriving ready to work or study’, ‘unwinding after the day’ and appreciating a sense of a break between work and home. Others talk more generally of gaining a sense of well-being from riding. These generalised health-related benefits are highly valued.

2 Chapman, L.S. 2007 Proof Positive. An Analysis of The Cost of Effectiveness of Worksite Wellness. Seattle, WA: Chapman Institute

- As the cost of fuel has increased and the competition for road and parking space has intensified, there has been an increase in the awareness of the money and time-saving possibilities of bicycle use. Avoided motor vehicle running costs such as petrol and parking are most obvious to users. Capital and fixed costs can be avoided by some who can get rid of 'the second car'. These two avoided costs could amount to $10,000 in after-tax income. Some users can even get rid of the 'first car'.
- For many, mode shift is not from the car to the bicycle, but from public transport to the bicycle. These users often change from public transport to cycling to avoid the cost, crowding, inflexible timetable and unreliable public transport.
- For the majority of people, their fitness and health is already suffering due to a lack of dedication or time available for exercise. Riding a bicycle allows those people to easily build exercise into every day in a way that is hard to avoid. For others who already exercise regularly, riding a bicycle allows them to save the time and money spent on gym memberships or other activities dedicated to keeping fit.

As measurable and significant as some of these economic benefits are, it should be noted that riders are reluctant to pay to park their bicycle. Returnable deposits may be uncontroversial but weekly or daily parking fees significantly suppress potential usage, and riders are more likely to find a public place to park their bicycle. A number of private parking projects that sought to rely on rider subscriptions have failed.

3. Application-Specific Considerations

There are a wide variety of options available for parking and storing bicycles. While there are many general principles to follow, the decision of which parking solution to use and how to use it depends largely on the application.

3.1 Visitors and Customers

Bicycle Parking Facilities that are provided for visitors and customers can either be provided within the road reserve (via the Road Management authority) or within publicly accessible locations on private property adjacent building entrances (by developers or owners).

Bicycle Parking located in public spaces must consider the needs of people moving around the parking including:

- People crossing the road, walking past the parking and sitting down near it.
- Street activities such as conversing, busking and queuing for shops.
- Access to public transport.
- Walking with dogs or children.
- People accessing parked vehicles (including car doors and the boot at the rear).

The short-term (typically <3 hours) and infrequent nature of customer parking means that turnover is high, and therefore convenience of access it critical. Proximity to the final destination compared that offered by parking locations is also a key strategic benefit of cycling in shopping precincts. Where customer parking is placed in locations with high foot traffic and for short durations, the high security offered by *Bicycle Cages* and *Bicycle Lockers* is rarely needed.

Some developments with limited publicly accessible area (particularly residential) seek to accommodate staff within the building. In such circumstances, there is a need to provide strong wayfinding and communication, as well as providing an intercom adjacent the entrance to ensure visitors can ‘buzz in’ with their guest.

Cafes, restaurants and grocery stores are popular destinations for bicycle users. Destinations such as bulky goods stores would appear to be unpopular for bicycle users, however they are often made bicycle-friendly by having delivery services for large items. There are, however, some businesses that might never attract bicycle users such as a business that fits tyres to cars.

3.1.1 Informal Parking

On-street bicycle parking is often driven by demand from users who demonstrate their need through *Informal Parking* such as use of fences, sign posts railings. However, sometimes this can cause obstructions and street clutter. It is always preferable to accommodate demands in formal bicycle parking facilities.

Figure 32: This informal parking is an obstruction

3.1.2 Spare Space on the Footpath

Bicycle Racks can be installed in spare space on the footpath at low cost and with little impact on pedestrian access if placed correctly.

Figure 33: These two bicycle racks compete with on-street dining in café area

3.1.3 Spare or Underutilised Road Space

Road space can be reclaimed by providing kerb extensions in areas that are otherwise underused or unused. Such spaces exist anywhere a vehicle setback is required such as near intersections or pedestrian crossings. Note that the Australian Standard requires a minimum 500mm setback from the kerb to off-carriageway parking unless abutting a shared zone or a protective barrier is provided to prevent the bicycle entering the carriageway.

Figure 34: A kerb extension enforces vehicle setbacks and reduces pedestrian crossing distance.

Figure 35: This kerb extension creates space for bicycle racks

3.1.4 Re-purposed Car Parking Spaces

When limited space is available for bicycle parking on existing footpaths or when demand outstrips available space, it may be appropriate or necessary to replace car parking spaces to provide *Bicycle Parking Facilities*. These spaces are referred to as *Bicycle Corrals*.

Figure 36: This bicycle parking could be moved onto the road to free up the footpath

It can be controversial to re-purpose car parking spaces; however, a proven demand for informal bicycle parking is a strong motive for implementing *Bicycle Corrals*. To the contrary an unused *Bicycle Corral* may attract complaints and lessen the case for building further *Bicycle Corrals*. The corral should not conflict with other street utilities.

The following should be considered:

- Suitable at destinations which are well-established and popular.
- Treat each new location as a trial (around 6 to 12 months), preferably starting in the warmer months of the year when uptake is able to be proven.
- Use designs that can be easily relocated.
- Demonstrate success through case studies and by collecting usage data.
- Suitable for high-activation streets with good passive surveillance.
- Suitable at locations which good bicycle accessibility, i.e. near a popular bicycle route.
- Suitable at locations where using the car is already difficult.
- Identify an ‘opt in’ policy for business wishing to convert spaces along their direct frontage

More specifically, bicycle parking for visitors and customers should be:

- Located conveniently close to shop entrances.
- Located in visible, busy location for casual surveillance.

Figure 37: Supermarkets are usually attractive destinations

Figure 38: This bicycle parking is making some lazy space work harder. The area is too small for a car space but the parking still allows access to the switchboards

3.2 Workplaces

Commuting by bicycle is growing in many areas. Many developers and workplaces are including Bicycle Parking as a way of retaining staff and supporting lifestyle choices and health of their employees. Workplaces and particularly new developments should consider how they will accommodate bicycle parking demands over time, including the ability for retrofitting in future. This is covered in the section titled Bicycle Parking Demand (see p.64).

Employees will tend to leave their bicycles unattended, often in low-activity areas, for long periods of time (8-10 hours) and require higher security than visitors. *Parking Cages* are often the best choice for workplace parking as they provide increased security over *Bicycle Racks* alone but offer better space utilisation than *Bicycle Lockers*. Vertical hanging racks typically offer the most space-efficient form of Bicycle Parking for staff; however, designers should note that the Australian Standard requires that 20% of all spaces are horizontal ground level racks, for those who have difficulty lifting their bicycle.

While some employees will park their bicycle and get straight to work, others will shower because they have ridden a long distance or have been affected by wet weather. These users will require access to amenities such as showers and clothes lockers as described in detail in the section titled *Providing Amenities* (see p.119). Ancillary end-of-trip facilities are also used by non-cyclists, such as those who choose to exercise around day-time work commitments or those who walk or run as a means of travel.

Some workplaces may better-utilise existing car parking facilities by converting them to *Bicycle Parking Facilities* with *Amenities*.

Figure 39: A typical wall-mounted rack

Figure 40: This bicycle cage includes both floor-mounted and wall-mounted racks

Figure 41: Wall-mounted racks have been used to optimise space utilisation. It could be improved by providing floor-mounted racks for those who can't lift their bicycle

3.3 Residential Buildings

Bicycle sales in Australia have outpaced car sales for the past 14 years[3], leading to high bicycle ownership levels and placing a greater importance on providing *Bicycle Parking Facilities* in residential developments. The responsibility for providing these facilities often lies with the developer who is building properties with the hope of securing a high return on investment. A failure to provide any space where a bicycle, or several bicycles, can be stored can reduce the appeal of a property and reduce the potential return on investment. It can also lead to some bicycle owners storing bicycles on balconies, and be an aesthetically undesirable outcome for some Body Corporates or residents.

3.3.1 Single-Dwelling Residential

Properties with lock-up garages allow for bicycles to be parked within a secure and private garage area. The eventual owners of these properties can then decide how to park their bicycle. They may simply rest the bicycle against the wall in the garage or may use *Domestic Bicycle Parking* products with the aim of keeping the bicycle out of the way.

Figure 42: Bicycles parked in a domestic garage

3 National Cycling Strategy Implementation Report 2013, Austroads 2013.

3.3.2 Multi-Dwelling Residential

Multi-dwelling residential developments such as apartment buildings may be designed with open-plan car parking areas with spots allocated to particular residents. While these spaces are accessible to residents and sometimes their visitors, they are typically secured from the outside world using roller-doors or similar.

These spaces, while not being open to the general public, are not particularly secure. The security door is usually quite easy to circumvent by following others as they open the door. This low level of security makes it important that bicycles are not left unlocked.

There are two main approaches to providing *Bicycle Parking Facilities* in these areas.

1. Installation of *Floor-Mounted Racks* or *Wall-Mounted Racks* in the car park with no additional secure structure.
2. For developers who are looking to achieve a higher return on investment, the addition of a *Bicycle Cage* is a small investment that can deliver a much more appealing product for buyers.

Figure 43: This bicycle cage provides enhanced security over bicycle racks alone

3.4 Public Transport

In recent years, a number of government documents have highlighted the link between active transport and public transport usage. Public transport can be made more attractive by providing *Bicycle Parking Facilities* to enable cyclists an intermodal transfer to public transport.

To maximise multi-modal travel, *Bicycle Parking Facilities* should be located as close as possible to the transport node entrance without impeding pedestrian movements, and away from passenger alighting areas. The design of the *Approach* also needs to consider the comfort and safety of pedestrians.

Passengers are typically more time-poor in the morning and will look to park as close as possible to their platform or stop. It is still possible to provide successful *Bicycle Parking Facilities* on the ‘down’ side, but only if they are right next to a rail underpass or bridge that allows passengers to get quickly to their train or bus. As such, the default location for a *Bicycle Parking Facility* at public transport nodes should be on the ‘up’ side of the line (i.e. where most passengers board services in the morning to travel to work). The ‘down’ side is the other side, where most passengers disembark on their way home.

Benefits mentioned in research by passengers who arrive at public transport by bicycle include:

- A bicycle trip of three kilometres is quicker than a one kilometre walk.
- There is no need to wait for a bus or to look for a car space.
- A passenger who rides on three days of the week could easily accumulate half the minimum physical activity they need to stay healthy.
- Their car is not exposed to weather damage or theft.
- Parking fines are avoided[4].
- There can be savings on running costs or less need to own a motor vehicle (or as many motor vehicles). The 'station' car can be redeployed within the household or sold.
- There are people who live beyond the walking catchment but don't have full-time access to a car or a bus route. Making cycling a feasible option lessens transport disadvantage for and improves mobility for these users.
- A driver's license is not required.

The images in Figure 44 and Figure 45 were taken at the same train station and show the success of the *Bicycle Cages* placed (Figure 44) and the lack of use of the *Bicycle Racks* (Figure 45).

Figure 44: Successful parking located at the 'up' platform

4 Around 10,000 parking penalty notices are issued each year around rail stations in Perth.

Figure 45: Unsuccessful parking located at the 'down' platform

3.4.1 Bus and Tram Stops

Over short distances, single mode bicycle trips will compare favourably to multimodal trips (bicycle combined with bus/tram) as the travel time of the bicycle trip is comparable to the travel time of the bus/tram trip. Single mode bicycle trips may also be more attractive than multimodal trips where the public transport network is overcrowded or faces frequent delays.

Where trips are longer and where public transport services are regular and efficient, multimodal trips are an increasingly attractive option. This is especially the case where buses and trams are designed to offer high-speed, long-distance services on separated facilities such as bus lanes and tram fairways.

Where multimodal trip demand is high, there is a subsequent increase in demand for bicycle parking at bus/tram stops which needs to be supported and encouraged through the provision of additional bicycle parking.

3.4.2 Train Stations and Ferry Terminals

Heavy rail is a popular form of transport, especially for journeys to work. In Australia, passengers usually access train stations by foot or by car. The walking catchment radius is around 1 km and up to 2 km which can be significantly extended to around 5 km for the bicycle catchment. These short trips less than 5 km take less than 20 minutes and can be undertaken in normal work clothes.

A 2009 report[5] showed that passengers in Sydney were arriving at public transport by bicycle after riding 'for less than twenty minutes for up to 6 km'. Similar results are found on the Melbourne system. Bicycle trips to rail stations are most likely to be made for journeys of between 1 and 3 km.

5 The provision and use of bicycle parking at NSW public transport interchanges. Results of facilities audit and cyclist questionnaire. Prepared for the Premier's Council for Active Living. March 2009

Benefits mentioned in research by passengers who arrive at public transport by bicycle include:

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- There is no need to wait for a bus or to look for a car space.
- A passenger who rides on three days of the week could easily accumulate half the minimum physical activity they need to stay healthy.
- Their car is not exposed to weather damage or theft.
- Parking fines are avoided.
- There can be savings on running costs or ownership of a motor vehicle.
- There are people who live beyond the walking catchment but don't have full-time access to a car or a bus route.
- A driver's license is not required.

Train stations that attract active travel passengers share some or all of the following features:

- They are more than 5 km from a destination such as a CBD. Few passengers will ride to a station that is less than 5 km from their destination preferring to ride all the way. The further the station is from the destination, the better heavy rail competes with a direct bicycle trip.
- They are easy to ride to along paths, trails or dedicated bicycle facilities.
- They are difficult or inconvenient to reach by car or bus.

The presence of informal bicycle parking indicates a demand for *Bicycle Parking Facilities*, however, it should also be noted that potentially-successful locations may have no informal parking due to fear of theft. Trial facilities are recommended where suppressed demand is suspected.

Figure 46: More than a hundred riders arrive at Fremantle Station each day by bicycle

Figure 47: This bicycle cage provides an appropriate level of security for bicycles left all day where passive surveillance is low

3.5 Large Sites

Sites that fall in this category include university campuses, shopping centres, airports, zoos, business parks and tourist attractions. They consist of a number of buildings and internal roads on land under the control of a non-government authority. The site operator has the ability to influence how people arrive and is responsible for travel between buildings and around the site.

Competition over land use on these sites is usually strong, with unused space increasingly being reclaimed for more buildings and car parking. Bicycle parking can provide a good return on investment, enabling greater access to destinations while reducing the need to provide additional car parking.

Bicycle parking on large sites usually needs to be provided for two audiences: the staff and the customers/students/visitors. In some cases, such as universities, the students outnumber the staff and in other cases such as a business park, staff will outnumber visitors. The bicycle parking provision is likely to be different for the two groups and could be considered as two separate projects.

Staff are likely to attend the site on a daily basis and to stay for long periods each day. Providing for this group is the same as providing for staff at any workplace. In some instances, students can be accommodated in a similar manner as staff, as they are typically regular users over the long term and can be set up with swipe card access. This is covered earlier under *Workplace Parking.*

Customers and visitors make more irregular, infrequent and short trips to the site and bicycle parking should be provided in the same as for customers to any business. This is covered earlier under *Visitor and Customer Parking*.

Figure 48: This parking provides visitor (student) parking for a university campus

3.5.1 Access to the Campus

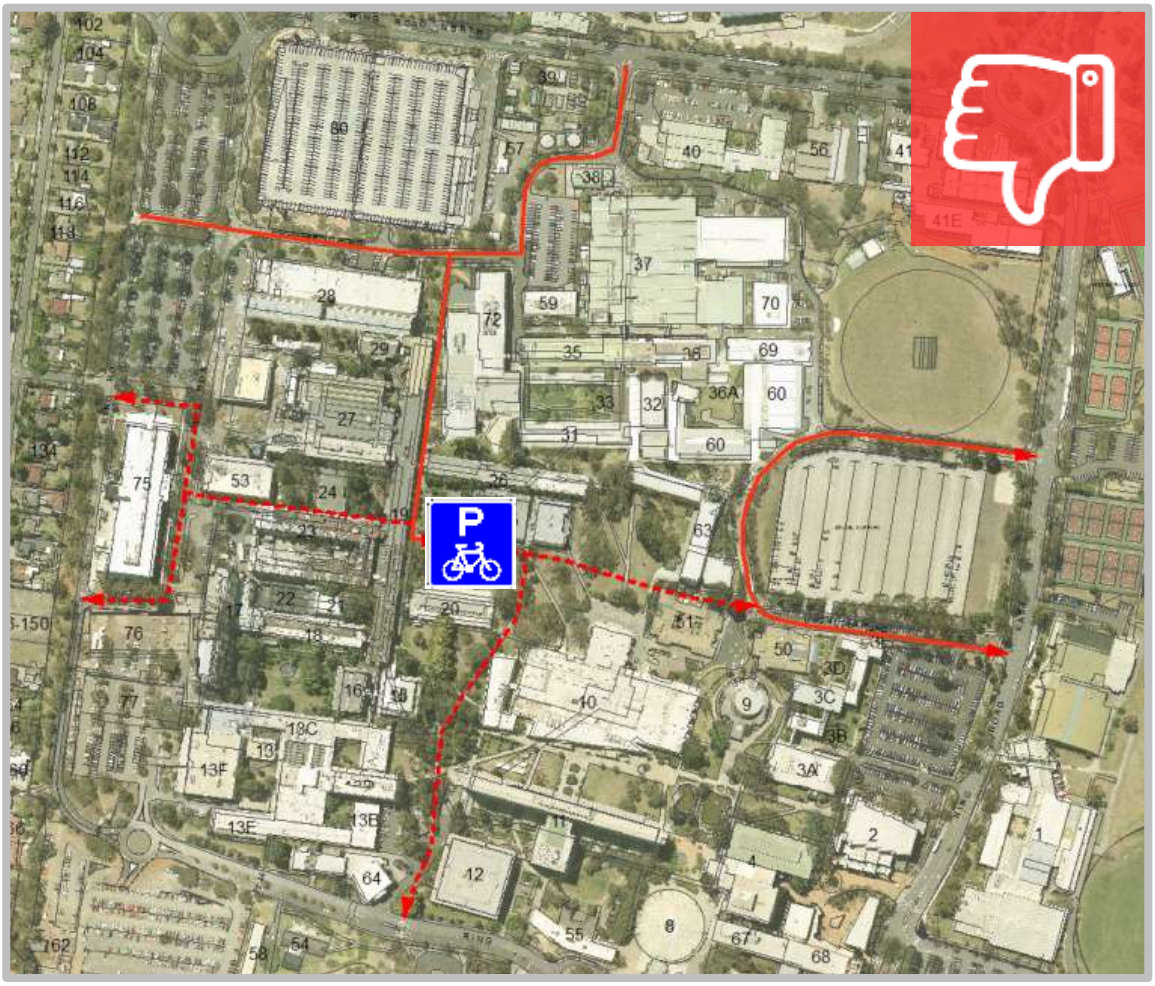
Bicycles will access campuses both through the road network and through pedestrian entry points. This flexibility provides the bicycle with an advantage over arriving by car and should be encouraged. However, the comfort and safety of pedestrians needs to be considered, with separated bicycle paths provided where conflicts are unable to be suitably managed through urban design or treatments such as shared zones. The comfort and safety of bicycle users should also be ensured through the separation of bicycles and motor vehicles where appropriate, having regard for the prevailing traffic speeds, traffic volumes and the ability for the carriageway to be shared.

The surrounding *Bicycle Network* as well as the geographical distribution of arrivals should be used as a guide to determine where campus access points should be provided, and subsequently, where *Bicycle Parking Facilities* should be located*. Bicycle Parking Facilities* should always be as close to destinations as possible but should not invade into highly pedestrianised areas.

The larger the campus, the more important it is to have multiple access points. Multiple access points allow riders to reach their destination without being forced to travel longer distances.

The bicycle parking access map below illustrates an approach that could produce problems, with bicycle users being forced to the perimeter and towards car parking facilities rather than towards destinations. In this example, a secondary parking facility could be considered on the eastern side of the site.

Figure 49: A bicycle access map which demonstrates that access is circuitous



3.5.2 Bicycle Use Within the Site

Before deciding where to place parking, the first decision to make is where to permit cycling and where to forbid it. In deciding this, it should be recognised that good design that encourages compliance is always a better solution than regulation. Attempts at prohibiting cycling can often fail and result in enforcement issues. It should be recognised that in some instances, bicycles may also provide a useful mode for intra-site travel, such as within large universities.

The decision of where and how to restrict bicycle access will depend heavily on the existing design of the campus. Most Australian universities are low-density and allow the students access to the whole campus. Smaller and older universities such as Utrecht and Oxford are denser and do not permit cycling on the grounds. The Dubbo Zoo is low-density and allows visitors to ride through the site. However, smaller, high-density urban zoos do not permit bicycle riding.

Low-Density Campuses

Large, sprawling campuses with many internal roads will have a ready-built network of streets to provide direct access to many parts of the campus. In these cases, the provision of a safe environment for pedestrians and bicycle users along these corridors is important. Separated bicycle infrastructure, shared zones, low speed limits and traffic-calming measures should all be considered.

Bicycle Parking Facilities should be located within easy reach of the internal road network and close to destinations. This will minimise the need for bicycles to leave the main corridors and join busy pedestrian thoroughfares. Low-density campuses may have wide pedestrian boulevards and, for the most part, there is little danger in allowing cycling to occur in these pedestrian areas.

Figure 50: This bicycle parking is located along an internal road which functions well as a shared zone

High-Density Campuses

Compact, high-density campuses may have limited room to accommodate pedestrians and bicycles. In some cases, it will be necessary to define areas, or a perimeter, within which cycling is discouraged. In these cases, *Bicycle Parking Facilities* should be located at the edge of the perimeter to encourage riders to leave their bicycles at the perimeter. The distance from the parking to the destination is a key factor in encouraging compliance with a 'no-riding' perimeter. If the rider is required to leave their bicycle hundreds of metres from their destination, the scheme would likely be ineffective.

Figure 51: The parking on this school campus is on the perimeter

3.6 Events

Bicycle Parking Facilities can play an important role in making large events run smoothly, especially where surrounding transport systems (including car parking, roads and public transport) are stressed. By providing an alternative means of access to the site, the bicycle can reduce demand on public transport, road networks and car parking, and support the event success.

An observed lack of *Bicycle Parking Facilities* at some major events may be due to a perception that the market for bicycle trips is small or that bicycle traffic will be difficult to manage. There may even be a feeling that because bicycle parking is not a revenue generator, it is not a high priority.

Despite these perceptions, there are a number of good reasons for providing *Bicycle Parking Facilities* at large venues:

- Permanent or well managed Temporary *Bicycle Parking Facilities* reduce the risk of injury that *Informal Parking* can present, particularly when large volumes of attendees are leaving a venue due to blocking of pedestrian walkways, fire escapes or other critical access corridors.
- *Bicycle Parking Facilities* are a very cheap and space-efficient way of providing parking to a large number of attendees.
- Typically, many major events cannot provide car parking supply to meet demands, so there is little risk of the venue losing revenue.

3.6.1 Demand for Bicycle Parking at Events

At locations that hold regular events such as stadiums or racecourses, demand can be estimated by observing *Informal Parking* and bicycle counts on the surrounding *Bicycle Network*. The venue can then install *Formal Parking* to exceed this demand, playing close attention to the access corridors used by bicycle users.

At a location where a temporary event is held, such as a fun run or community festival, *Temporary Parking* is more suitable than the more expensive installation of *Formal Parking*. If the event is held regularly (even once a year), an audit of *Informal Parking* can help to determine the level of demand for bicycle parking. If an event is occurring for the first time, it will be difficult to predict the scale of bicycle use and which entrances/locations are most appealing to those arriving by bicycle.

3.6.2 Location of Bicycle Parking for Events

Venues that host large events need to deal with demand that is very high for short periods of time and will tend to have multiple entrances that are required to support high pedestrian volumes.

It is important that *Bicycle Parking Facilities,* either permanent or temporary, are placed close, but not too close to entrances. If they are too far away, users will ignore the parking and will start parking informally around the entrances. If they are too close, pedestrian flow will be impeded and safety will be compromised.

For many events, the greatest conflict arises after the event when everyone is attempting to leave at the same time. The placement of bicycle parking at event venues should focus on how to enable people to depart safely and quickly.

Figure 52: This stadium attracts a large number of riders

4. Bicycle Racks

The Bicycle Rack is the component of the Bicycle Parking Facility that allows the bicycle to be held in place and securely locked. There are many systems available but not all are standards-compliant or fulfil the requirements outlined in this report.

4.1 Principles for Bicycle Racks

4.1.1 Rack Principle One: Secures the Bicycle

The most basic requirement of a *Bicycle Rack* is that it secures the bicycle, either by enclosing it (such as Bicycle Locker) or providing fixed structure to which the bicycle can be locked.

The cost of the physical *Bicycle Rack* is a small portion of the overall lifetime cost of running a *Bicycle Parking Facility*. A slightly higher cost yet durable bicycle rack may provide the best value compared to the cost of replacing or maintaining racks that fail.

A *Bicycle Rack* should be designed to allow easy access to the *Locking Zone* so that the front wheel, the rear wheel and the frame can all be secured.

Figure 53: This simple 'U-rail' allows the frame and both wheels to be secured

The *Bicycle Rack* will need to be resistant to cutting by portable tools and should not be vulnerable to unauthorised disassembly. Systems that are assembled (as opposed to welded) can become loose or even fall apart through prolonged usage, and need to have locking and anti-theft fixing methods incorporated.

The rack may have to cope with graffiti, rust and other outdoor risks. *Bicycle Racks* used outside are now generally stainless steel. Stainless steel usually meets the aesthetic requirements of the *Bicycle Rack*. Painted steel is cheaper initially, but the paint chips and the rails require recoating during their life. Racks used inside can be galvanized, painted or coated with high-density nylon or similar material.

Bicycle Racks with moving parts tend to be less durable than those without. Moving parts need to be regularly checked and maintained. This imposes a hidden cost on the provider which should be considered before purchase.

Figure 54: This bicycle rack is not constructed with robust materials and can be cut easily

4.1.2 Rack Principle Two: Safe for Bicycles

A *Bicycle Rack* needs to ensure that bicycles remain undamaged in the process of parking.

Two Points of Support

The *Bicycle Rack* must provide support at two perpendicular points to prevent the front wheel from turning and the bicycle from falling. Poles used for street signs make good informal parking locations but do not adequately support the bicycle, often leading to the bicycle pivoting and falling. Some ineffective *Bicycle Racks* are too narrow and do not support the length of the bicycle.

A *Bicycle Rack* should support the frame from the handlebars to the saddle and therefore should be around 750mm long between supporting points. A support that is shorter than this is unlikely to provide adequate stability.

Figure 55: This bicycle has pivoted on the single point of support and fallen

Vertical Interface

If the *Bicycle Rack* is vertical and keeps the bicycle vertical, it is easier to use and is more likely to keep the bicycle from falling. The spiral racks shown below illustrate how bicycles parked angled *Bicycle Racks* often become unstable.

Figure 56: This bicycle rack does not provide a vertical interface

Adequate Spacing

Bicycles can be damaged during the wrestling motions required to extract bicycles from *Bicycle Racks* that are too closely-spaced.

Figure 57: In this situation a user could damage the neighbouring bicycle when they come to remove their bicycle

Take Care of Rims

Rims are very strong when force is applied radially in the same axis as the wheel. Rims are not as strong if forces are applied laterally against the edge of the rim or against the spokes. This is especially true for lightweight wheels. *Bicycle Racks* that support the bicycle by holding the front wheel in a channel can expose the edge of the rim or spokes to forces that can buckle the wheel. While these sorts of *Bicycle Racks* are commonly-used in Europe where bicycles are usually more robust, they are not recommended for use in Australia.

Figure 58: These racks will damage the rims as they do not support the frame

Take Care of Spokes

The front wheel rim supports on a *Wall-Mounted Rack* (as shown in Figure 59) can cause damage to spokes. The 'pin' placement must allow for variation in wheel diameter and spoke patterns, and is ideally covered with protective rubber. An effective approach is to provide a single pin and to allow the tyre to rest against the wall for stability.

Figure 59: This system could damage the spokes on the bicycle over time

Correct Height

Bicycle Racks that are too low can lead to the bicycle toppling over. *Bicycle Racks* that are too tall do not allow for the horizontal section to be used to secure the horizontal frame of the bicycle.

Figure 60: This rack is too low and does not provide adequate support for the frame

Figure 61: These racks are too high to allow the horizontal section to be used as a locking point

4.1.3 Rack Principle Three: Suits Common Bicycles

Accommodate the Standard Bicycle and Bicycle Spacing Envelope

Bicycle Racks must accommodate the *Standard Bicycle* (see p.4) and should consider the following when choosing dimensions and spacing:

- the *Bicycle Spacing Envelope* (see p.5), and
- the *Australian Standard for Bicycle Parking AS2890.3:2015*.

Bicycle Should Rest on Wheels Rather than the Frame

Bicycle Racks can be designed so that the bicycle rests on the bicycle frame but, in general, these systems are best-used for domestic systems. Bicycle frames vary so much that *Bicycle Racks* that attempt to support the frame will usually not serve the whole market. Instead, *Bicycle Racks* should support the bicycle on its wheels either on the ground or hanging vertically.

Where bicycles will be hung by their front wheel from a wall-mounted hook, consider that wheels may have deep section rims (80mm or more) and fat tyres (75mm or more). Hooks should be designed with soft coatings and without sharp edges to ensure that they do not scrape or damage rims.

Figure 62: This style of rack relies on the bicycle having a horizontal top tube and is unsuitable for public bicycle parking installations

Cater to Special Demographics where Necessary

Some locations will need to cater to a particular demographic who use a specific type or size of bicycle. For example, locations such as primary schools will need to implement a *Bicycle Rack* that is suitable for children's bicycles. It may also be common for children's bicycles to remain unlocked in school grounds. In this case, a system that holds the bicycle in place is especially important.

4.1.4 Rack Principle Four: Simple and Safe

Bicycle parking must be easy and intuitive to use. Ideally, there should be no need for lengthy descriptions of how to use the parking and it should require very little concentration or effort. The user should not have to strain or risk injury in the process of parking a bicycle. Some designs fail because they are too tight, too high, too heavy, too arty or too clever.

Simple Design

A successful *Bicycle Rack* will allow for common variations within the *Bicycle Spacing Envelope*. Simple systems do this easily. More complex systems, particularly those that require the bicycle to be carefully fitted, often do not.

Bicycle Racks fail when they are designed around one type of bicycle. Some systems assume that all bicycle handlebars are narrow or that all wheels and tyres are strong and wide. Others assume every bicycle has a top bar. Some will not park bicycles with mudguards or accessories on the handlebars.

Not Too Tight

Some *Bicycle Racks* go too far in the effort to save space and place bicycles too close to each other. When bicycles are parked too close together, they usually become entangled which makes access difficult and frustrates users. Removing bicycles from a tangled mess can result in damage to the bicycle or injury to the user. Any rack that requires the user to touch or manhandle a bicycle that is not their own in order to park or un-park their bicycle should not be considered.

Figure 63: An example where the space between the bicycles is too tight

Not Too High

When a bicycle is parked off the ground, the issue of lifting needs to be considered. Excessive or inappropriate lifting significantly reduces usability and exposes the user to risk of injury. Any facility that provides parking that requires the user to lift the bicycle should also provide *Floor-Mounted Racks* for people who are shorter, less strong, have a back injury or have a heavy bicycle such as an e-bike.

The Australian Standard notes that the maximum height of the hanging point should be no higher than 2150, resulting in a 350mm lift off the ground assuming a standard bicycle.

Figure 64: This wall-mounted rack has been installed too high so that the back wheel is 450mm off the ground

Not Too Arty

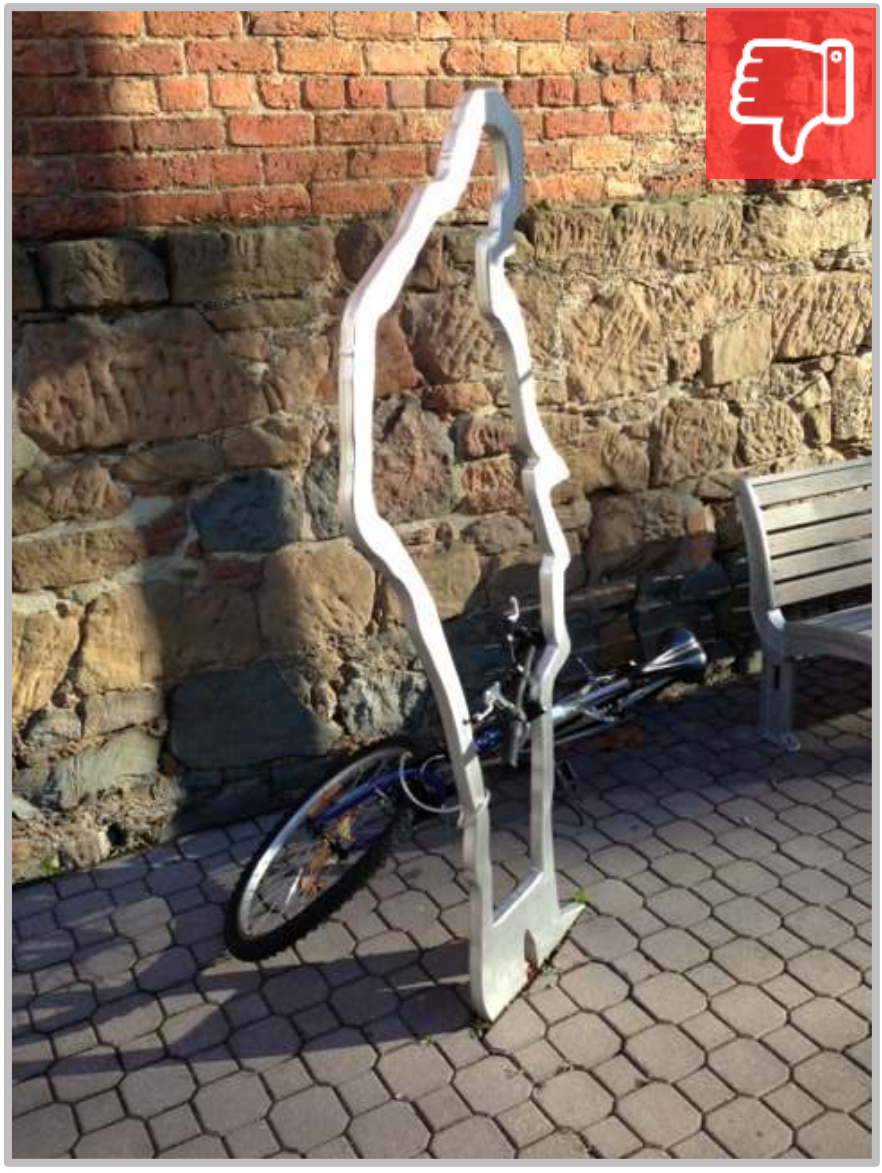
Bicycle Racks are sometimes provided in the form of a sculpture. This is an unusual phenomenon that is rarely seen for other utilitarian items of street furniture such as parking meters, rubbish bins, way-finding signs and poster cylinders. It is also rarely seen in countries where there are high levels of bicycle use.

The provision of artistic *Bicycle Racks* is often done to improve the streetscape and to provide some interest to an otherwise dull, utilitarian piece of street furniture. Unfortunately, there are often a number of drawbacks to providing Artistic *Bicycle Racks* including:

- They can cost more than simple *Bicycle Racks,* particularly if custom made. This will reduce the number of *Bicycle Racks* that can be installed for a given budget.
- They will rarely be able to provide the same level of parking density, ease of use, stability and other performance factors that are optimised in more utilitarian designs.
- They are often ambiguous in their purpose and don't clearly indicate that they are to be used as a *Bicycle Rack*.

For these reasons, it is recommended *Bicycle Racks* remain simple, obvious and utilitarian rather than artistic.

Figure 65: This artistic rack is too narrow and may have been an expensive way to park two bicycles



Not Too Clever

Some *Bicycle Racks* require are difficult to use and may require the user to lift, push, roll, balance and / or carefully fit the bicycle.

Figure 66: Many riders have chosen not to use these bicycle racks

Figure 67: A user has chosen to stabilise the bicycle by putting it upside down

4.2 Types of Racks

4.2.1 Floor Mounted Rack Units vs Rack Modules

Rack Units

Rack units are standalone *Bicycle Racks* that can be purchased as individual units and are designed to park only one or two bicycles. The respective advantages and disadvantages of rack units are set out below.

Table 2: Bicycle rack unit advantages and disadvantages

Advantages	Disadvantages
Generally, rack units are more flexible.	Rack Units typically have a higher installation cost per parking space. They are also open to being installed improperly.
Rack units allow the designer to buy exactly the number of parking spaces they need.	
Rack units allow the designer to maximise the space available.	
Rack units can be moved around, put at different angles and fitted into smaller spaces than *Rack Modules*. They can also be placed on-street to provide Bicycle Corrals.	

Rack Modules

Rack Modules provide parking for several bicycles (more than 2) per structure. They come in many configurations and often aim to achieve compact spacing. A *Bicycle Parking Facility* can make use of both *Rack Modules* and *Rack Units* in one installation to gain some of the advantages of *Rack Modules* but also gain the flexibility of *Rack Units*. The respective advantages and disadvantages of rack units are set out below.

Table 3: Bicycle rack module advantages and disadvantages

Advantages	Disadvantages
The installation cost per bicycle parked is lower because the modules require fewer and often simpler fixing points than Rack Units.	Modules that are free-standing can often drift and end up in poor locations.
A well-designed module reduces the chance that the installation will be poor.	Many modules are poorly-designed and force an ineffective layout such as the inadequate centre spacing shown in Figure 71. Unlike Rack Units, reinstalling the rack cannot solve the problem.
	They are less flexible than individual Rack Units which can be arranged to take advantage of unusual spaces.
	They are often installed as a quick and dirty fix rather than to provide an effective Bicycle Parking Facility.

Figure 68: Rack units have been used to create a customised layout to fit this unusual space and allow a high number of bicycles to be parked

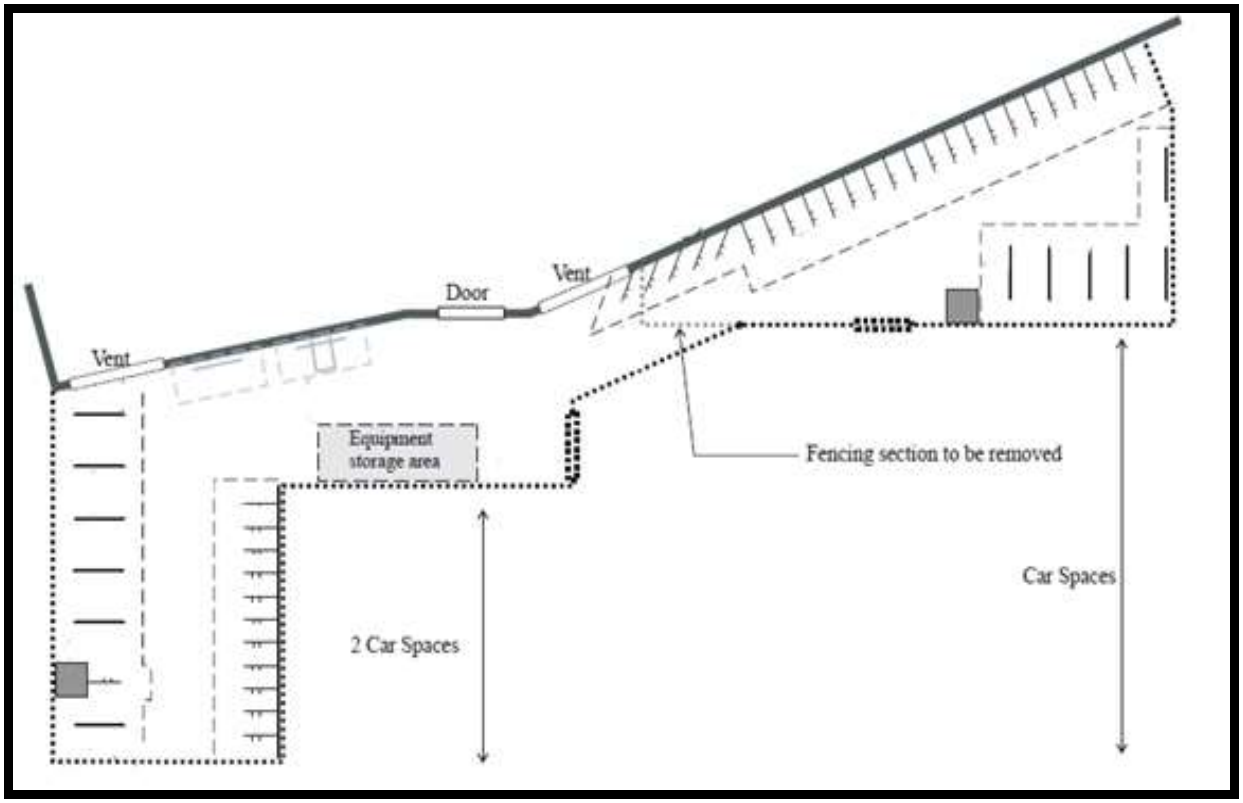
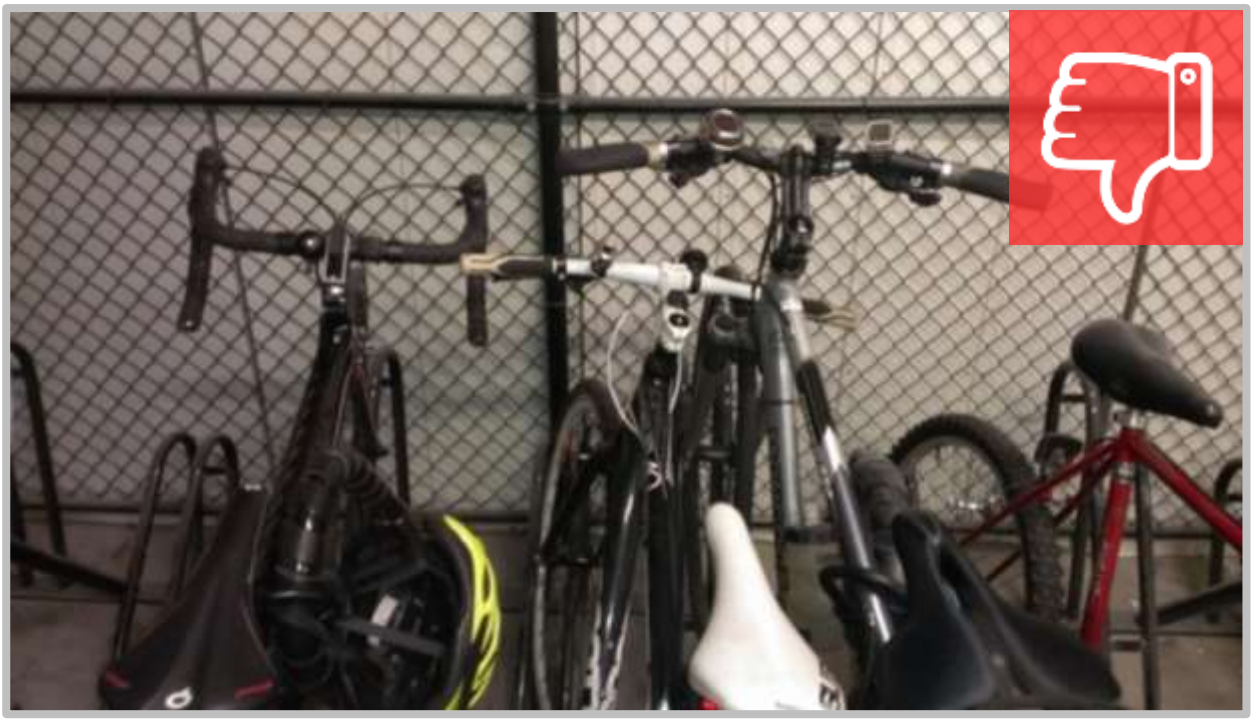


Figure 69: These rack units have been installed too close together and on a surface that is likely to get churned up by bicycle and foot traffic

Figure 70: These rack units have been installed too close together both in terms of centre spacing and because no aisle has been provided between rows

Figure 71: These staggered racks do not allow for enough space between bicycles



4.2.2 Types of Floor-Mounted Rack Units

Floor-Mounted Rack Units are easy to use and effective. They are usually the chosen rack for on-street applications where their ease of use and durability make them ideal for daily use. A well-designed *Floor-Mounted Rack Unit* is very versatile and can usually provide parking for non-standard bicycles and bicycles that are difficult to lift onto *Wall-Mounted Racks*.

Floor-Mounted Racks can be more expensive to install than *Pole-Mounted Racks*, however they have the following advantages:

- The location of the racks is not limited to the location of existing poles.
- They provide parking for two bicycles where *Pole-Mounted Racks* generally only provide room for one bicycle.
- They can be arranged in rows or placed on-street to form *Bicycle Corrals*.

Row Parking

Row Parking is the standard configuration for *Floor-Mounted Racks* and should be chosen when there is sufficient space to provide for the length of the bicycle and an adequate *Aisle*. *Row Parking* comprises *Bicycle Racks* installed with each rack 90 degrees to the access aisle. When two rows of *Floor-Mounted Racks* are installed, it is possible to offset the racks and reduce the required lengths of the rows, outlined in Figure B5 (b) of the Australian Standard.

Figure 72: This bicycle parking facility uses popular and effective U-rail bicycle racks

Angle Parking

Angled parking that is not 90 degrees to the access aisle, such as at 45º or 60º is called *Angle Parking*. *Angle Parking* is useful when the space is too narrow to provide standard *Row Parking* while maintaining an adequate *Aisle*. *Angle Parking* is not as space-efficient as *Row Parking*.

Figure 73: Angle parking installed in a bicycle corral

Inline Parking

Floor-Mounted Parking should be installed *Inline* when the available space is limited and the *Aisle* width behind the parking would otherwise be compromised. While this configuration allows for the use of spaces that are otherwise too narrow to allow for an adequate *Aisle*, however *Inline* parking is not as space-efficient as *Row Parking*.

Figure 74: This parking uses an inline configuration to suit the narrow footpath

4.2.3 Types of Floor-Mounted Rack Modules

Non-Staggered Floor-Mounted Rack Modules

Most *Floor-Mounted Racks* that are sold as *Modules* are configured as *Row Parking* as shown in Figure 75. Before choosing this form of parking, it is worth considering the advantages and disadvantages of *Modules* vs *Units* (see Section 4.2.1).

Floor-Mounted Racks that are sold as *Modules* (fitting more than 2 bicycles) should be designed to meet the same minimum clearance requirements as the *Australian Standard*.

Figure 75: This rack module provides guaranteed spacing and low-cost installation

Staggered Floor-Mounted Rack Modules

Some *Floor-Mounted Racks* offset bicycles parked on the ground by raising the front wheel of every second bicycle. This ensures that the widest part of the bicycle, the handlebar, is separated by some space vertically. This reduces the likelihood that handlebars will clash and become tangled with other bicycles.

The increased clearance between handlebars afforded by staggering the front wheels often leads to the belief that the *Centre Spacing* of the design can be reduced. Reducing the *Centre Spacing* allows more bicycles to be parked in a given *Footprint,* but compromises access to the *Locking Zone.*

Staggered *Floor-Mounted Rack Modules* are popular in northern Europe where users don't tend to lock their bicycle to the *Bicycle Rack,* and can work well in a supervised *Bicycle Parking Facility* where bicycles do not need to be locked.

Where bicycles need to be locked (most applications), *Floor-Mounted Rack Modules* should be designed as per the *Australian Standard.*

Figure 76: These staggered racks are too tight with only every second space usable

4.2.4 Pole Mounted Racks

Poles used for street signage, electricity and other purposes can be used to attach *Bicycle Racks*. These racks can make suitably strong poles usable with a U-Lock, however do not necessarily increase overall bicycle parking capacity, as many of these poles may have already been used for *Informal Parking*. *Pole-Mounted Racks* provide improved stability for the bicycle and legitimise the use of the pole for parking. *Pole-Mounted Racks* can be removable, thereby enabling the use on a trial basis for high-demand locations.

Figure 77: This O-rack provides a cheap solution that bolts to an existing pole

Figure 78: This rack can be attached to a standard signage pole

4.2.5 Wall-Mounted Racks (Hanging Vertically)

Wall-Mounted Racks allow bicycles to be parked as though they have been wheeled up the wall. The bicycle is usually hung from the front wheel, which can easily support the weight of the bicycle. The main reason why *Wall-Mounted Racks* are used is to increase the number of bicycles that can be parked in a given area, as a vertical bicycle takes up less floor area than a horizontal bicycle.

The height of a *Wall-Mounted Rack* needs to be carefully selected to ensure that users are not required to lift their bicycle too high. When *Wall-Mounted Racks* are mounted with every second rack higher than the other, this becomes an even greater concern.

The requirements for Wall-Mounted Racks are specified in the Australian Standard, including that the maximum height of the hanging point shall be no more than 2150mm.

In addition, to ensure that handlebars do not clash, vertically aligned hangers should provide a minimum of 700mm spacing from centre to centre. Where a vertical offset of at least 300mm between hanging points is achieved (as shown in Figure 79) the spacing can be reduced to a minimum of 500mm from centre to centre. While *Wall-Mounted Racks* have space efficiency advantages, they are not suitable for all bicycles or for all users. *Wall-Mounted Racks* cannot easily be used to park heavy bicycles such as electric bicycles or bicycles with panniers or child seats. Physical lifting may be a challenge for some people and as such they may find Wall-Mounted Racks difficult to use. Some people who are weaker will find them difficult to use. For these reasons, *Wall-Mounted Racks* should always be complemented by a minimum of 20% *Floor-Mounted Racks*, as required by the Australian Standard.

Figure 79: The hanging rails are offset to prevent the handlebars from clashing

4.2.6 Double-Deck Rack

Double-Deck Racks aim to exploit any 'wasted space' above a row of bicycles parked on the ground. This type of *Bicycle Rack* is more space-efficient than *Floor-Mounted Racks,* but only if there is sufficient available headroom clearance, which varies depending on the specific system being used.

Double-deck Racks require the user to lift the bicycle, plus the lifting mechanism, up to a height of around 1.5m. As such, they are generally more cumbersome and time consuming to park a bicycle within compared with other Bicycle Parking Racks. The process for their use is illustrated in Figure 81 and Figure 82. The combined weight of the bicycle and lifting mechanism is usually above 20 kgs. Some designs aim to reduce the force required to lift the bicycle and lifting arm be using gas struts to aid the lifting motion.

These racks can be problematic for children, the elderly or those with mobility impairments. In addition to these drawbacks, it is often difficult to reach the *Locking Zone* when a bicycle is parked in a *Double-Deck Rack*. Although these *Bicycle Racks* are widely used in Europe, they are not currently widely used in Australia.

Figure 80: Double-deck racks as above are more space-efficient than single-deck

Figure 81: The bicycle is first rolled up the arm

Figure 82: The arm is then raised and slid to the back of the slot

5. Bicycle Parking Demand

A Bicycle Parking Facility that does not satisfy peak demand levels will suppress use and fail to capture the full benefits associated with encouraging cycling. Regular monitoring of parking demand is required to ensure supply is adequate.

5.1 Leveraging Off Existing Demand

5.1.1 Advertising

The area around a *Bicycle Parking Facility* provides an opportunity to promote its use. Often a *Bicycle Parking Facility* will have wall space at the entrance or on the outside of the enclosure where advertising banners can draw attention to available bicycle parking. If the facility is placed close to the destination (as it should) then these banners will be highly visible and more effective.

An advertising banner should include:

- a large bicycle stencil and 'P' signposting
- a description that encourages use. i.e. "Your best parking spot is right here"
- a contact phone number, website and/or email for enquiries.

Figure 83: This marketing banner highlights the convenience of bicycle parking

Traditional advertising could also be incorporated to help generate funding to maintain the existing facilities, provide additional ones and encourage their use.

5.1.2 Develop a Travel Plan

Large employers such as universities, airports, business campuses and others can benefit from developing a *Travel Plan*. A Travel Plan is a set of strategies and actions aimed at promoting more sustainable travel choices with a specific emphasis on reducing single-occupancy car journeys. These plans often provide maps, timetables and other useful information or incentive programs to help people access the site and are particularly useful when the site has limited parking or when private car access is constrained

5.1.3 Select an Area that Facilitates Bicycle Use

Certain areas such as CBD areas are inherently more attractive to be accessed by bicycle. The choice to move a business to an area that is more attractive is often not available to those planning *Bicycle Parking Facilities*, but it should be recognised that location is a significant factor relating to the number of people that will cycle to their place of employment.

5.1.4 Provide Incentives

There are a range of policies and activities that workplaces, transport agencies, local governments and others can use to incentivise bicycle use and hence use of a *Bicycle Parking Facility*. They can form a bicycle commuter club, track/communicate usage of the facility, provide free health checks and provide free bicycle maintenance courses or learn-to-ride courses.

5.1.5 Remove Car Parking Subsidies

The land, building and administrative cost of providing car parking to employees, shoppers, residents and public transport users is significant. This cost is usually not paid by motorists, but is absorbed by the provider of the parking and bundled together to be paid by all users regardless of their transport mode. This creates an incentive for users to drive rather than to walk, cycle or use public transport.

Workplaces

Workplaces can ‘unbundle’ car parking costs by charging a daily fee for car parking and returning that money to all employees through a “transport allowance”. The employer will see a reduction in car use that will save fixed costs in the long run, but will not disadvantage employees. Those who choose to walk or ride a bicycle will be effectively given a pay rise while those who drive will not earn any more or any less. This will provide a strong incentive for a mode shift in employee travel behaviour.

Transport Agencies

Many Australian governments have spent significantly on car parking infrastructure at train stations. Rather than seeking to recoup some of this cost through user fees, this car parking is commonly provided free of charge in an attempt to encourage public transport use. This creates a subsidy for motor vehicle use, contributing to congestion and low parking availability.

Shopping Centres

Many shopping centres in Australia provide free parking for 2-3 hours to customers. The cost of providing this parking is paid by the centre owner who passes the cost to shop owners through higher rents. The notion of paying for car parking at an Australian shopping centre is something that draws strong protest from users and may result in customers moving their business elsewhere. It is therefore difficult to unbundle this cost. The best approach is to ensure that *Bicycle Parking Facilities* are provided in prime locations and encouraged in other ways.

Residential Developments

The provision of car parking in a residential property can be a contentious issue, with statutory planning requirements often setting minimum or maximum parking requirements. The cost of providing car parking is usually paid by all owners as it is ‘bundled’ in the price of their apartment. This ‘bundling’ reduces the ability of residents to choose how many spaces they would like. If parking spaces were sold on separate titles, some residents would choose to save a significant amount of money and not purchase a car space. This is particularly-relevant for low-cost housing projects, high density residential developments and/or with high level of accessibility by alternative transport modes.

5.2 Assessing Demand

5.2.1 Overview

Bicycle parking provision rates for developments are typically set out through the relevant statutory planning requirements. In the absence of such requirements, refer to the section on *Bicycle Parking Demand* (see p. 64) for guidance on minimum bicycle parking requirements.

Before setting out to manage the demand for public bicycle parking, it is first necessary to assess that demand. As it is important for bicycle parking to handle peak period demands, an assessment of the demand should be carried out at a busy time, when the greatest number of bicycles are present.

In trying to identify the peak demand for bicycle parking, it should be recognised that demand fluctuates throughout the day, week, month and year. Some locations tend to attract bicycle users at night time (cinemas, bars, restaurants) and some during the day (shops, workplaces). Some locations tend to attract bicycle users during the week (workplaces, train stations) and some during the weekend (parks, sports fields).

The demand for bicycle parking will also be subject to seasonal fluctuation throughout the year. In general, bicycle usage in Australia decreases in the winter months and on days with poor weather. The best time to get an indication of peak demand levels is on a fine day with a moderate temperature.

Average demand levels change over time and may be driven up or down by a variety of factors including by the provision of the parking itself. A regular process of data collection should monitor usage of *Bicycle Parking Facilities* so that future decisions are evidence-based.

Figure 84: During the day (left) this parking corral is not used, however, demand is high at night (right) when local venues are open for business

5.2.2 Record Existing Bicycle Parking

The simplest method of assessing demand is to visit a site and observe bicycles that are parked both formally and informally. Workplaces and other venues can usually see where users are currently parking their bicycles to gauge demand. Local councils should look in the following three places to locate existing bicycle parking:

1. Popular destinations such as:
   - Public transport nodes
   - Gyms
   - Swimming pools
   - Library
   - Cafes, coffee shops and other food and drink sellers
   - Pubs and bars
   - Bike shops

2. Popular bicycle routes
   - Informal bicycle parking is often present along popular bicycle routes.

3. Stressed car parks
   - Informal bicycle parking is often present near locations that are hard to drive to and park at.

Figure 85: There is an obvious need for more bicycle racks at this location

5.2.3 Monitoring Technology

A variety of technologies such as swipe-card readers, infra-red detectors, loop detectors and CCTV cameras can be used to monitor the usage of *Bicycle Parking Facilities*.

Swipe-card readers are increasingly being installed in conjunction with *Bicycle Parking Facilities* at train stations, but are also quite common in workplaces where an employee's security tag can double as a pass to access bicycle parking facilities. This type of monitoring technology provides a detailed breakdown of data regarding the usage of a *Bicycle Parking Facility*. In addition to knowing the time of access, the system knows the identity of the user which could be used to assess frequency of use or even distance travelled (for a company that has the address of each employee).

Infra-red detectors or loop-detectors can monitor traffic in and out of a facility but provide less information than a swipe-card reader. While the data will give an indication of how many users accessed the *Bicycle Parking Facility*, the identity of each user is unknown.

CCTV cameras are primarily installed to provide security benefits. However, they can also provide information about usage. It is time-consuming to gather data from CCTV footage so it is generally not affective for regular monitoring. Where CCTV footage can be of use is the ability to see how customers use the facility.

Figure 86: Common approaches to monitoring bicycle parking facilities

(A) A swipe-card reader

(B) An infra-red detector

(C) A CCTV camera

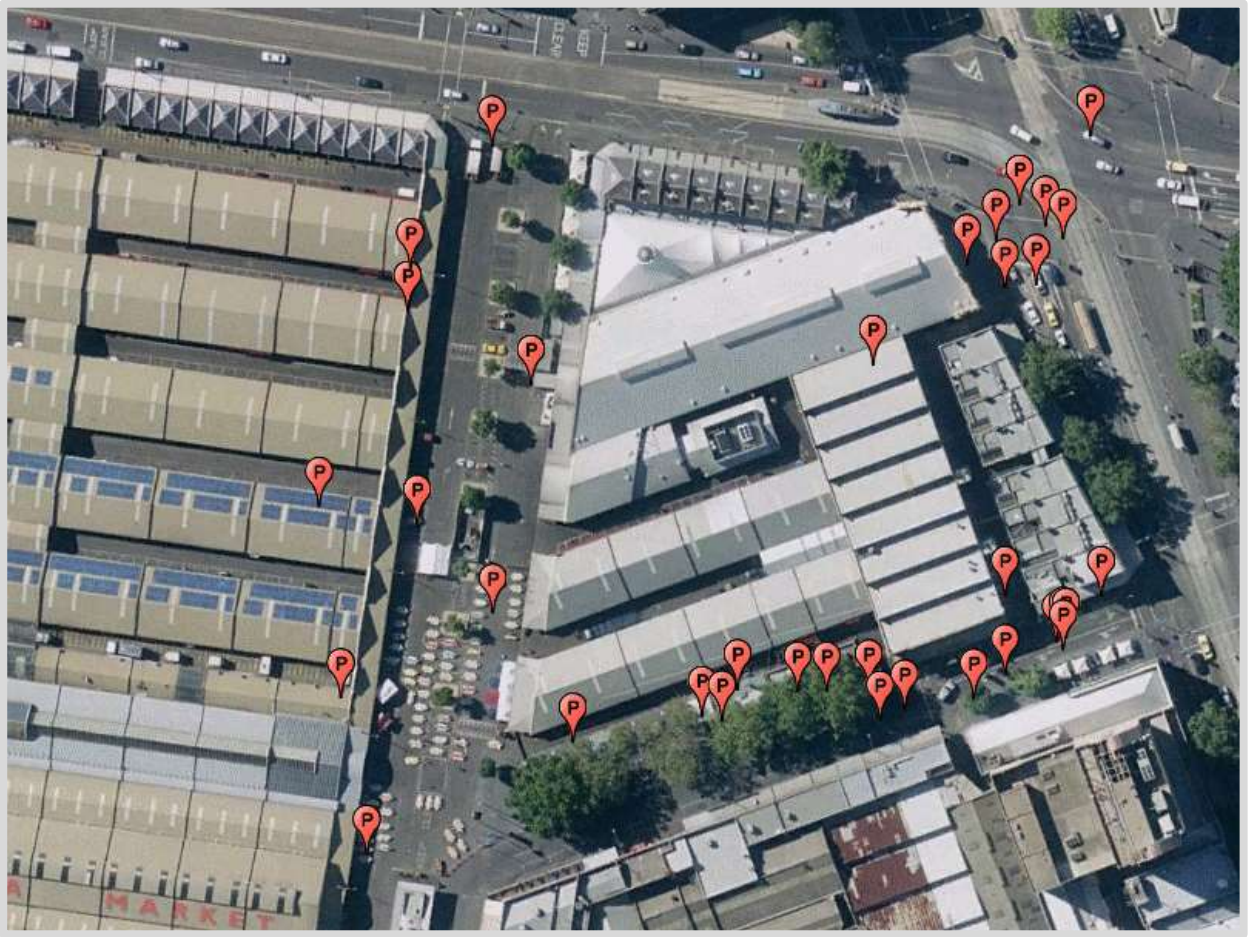
5.2.4 Crowdsourcing and Surveys

Crowdsourcing refers to the process of collecting data from a large number of people who volunteer their time and knowledge. In the context of bicycle parking, crowdsourcing can be used to identify locations that require bicycle parking.

There are a number of different ways to collect requests for bicycle parking, such as through surveys or through forms on websites. It is a good idea to use an online map interface to allow users to mark the exact location of where they park.

Crowdsourcing can generate a lot of requests, so it is important to respond in a measured way to waste too much time and energy dealing with minor issues. If many requests are received, the providing authority can look at aggregating a number of requests and responding with groups of racks in appropriate locations.

Figure 87: This map shows parking 'requests' provided through an online survey



5.3 Managing Different Stages of Demand

5.3.1 Managing Infrequent High-Level Demand

Some destinations, such as stadiums, can have high peak use for a short period followed by long periods of low use. In these situations, *Temporary Parking* may be the best use of space and capital. Occasional events, such as festivals and triathlons, are also often better served by *Temporary Parking* (see p.17).

5.3.2 Managing Low-Level Demand

If there are no readily-visible *Bicycle Parking Facilities* available close to a destination, bicycle users will find inventive solutions to secure their bicycles. Sometimes these solutions can pose a risk to pedestrian traffic or may obstruct access to important areas such as fire equipment, rubbish collection zones or emergency escape doors.

Figure 88: Informal parking can compromise access to firefighting equipment and other important services

Riders who commute to work will often park their bicycle in storerooms and other infrequently-used spaces. Riders will also park their bicycles by their desk which may create undesirable clutter. Bicycles parked in such places make access difficult and can be a tripping hazard.

Figure 89: This bicycle could fall and become a tripping hazard during an emergency evacuation

Figure 90: This bicycle creates a hazard to people using the storeroom

While the presence of informally-parked bicycles can be frustrating for building managers and others responsible for maintaining a safe environment, it is a useful sign that there is an unmet need for bicycle parking. Building managers and those with occupational health and safety responsibilities should monitor buildings to see if informal bicycle parking is occurring and look to address the demand by installing formal *Bicycle Parking Facilities*.

Attempting to stop bicycle users from parking when there are no alternatives is counter-productive and often unsuccessful. Even if successful in stamping out the parking of bicycles in dangerous locations, the intervention will have missed the opportunity to encourage bicycle use and capture the many associated benefits outlined earlier.

Figure 91: The handlebars offer a tripping hazard to people using the stairs

When there is low demand, it is often sufficient to provide a small number of spaces at a number of distributed locations. These spaces can often be found by transforming areas that are poorly utilised. For example, storage areas, rubbish bin zones, building services or other lazy space can be used. Carparks often have zones where it is difficult to park a car or where parking spaces are larger than the car due to lowered ceilings or building pillars.

After providing *Bicycle Parking Facilities* that meet the initial demand for bicycle parking, the situation should continue to be monitored. If the level of demand remains constant, then the facilities have met the demand. However, in many cases, providing facilities releases suppressed demand, which results in a growth in bicycle use. When this occurs, consideration should be given to providing more substantial *Bicycle Parking Facilities* as outlined in the next section.

5.3.3 Managing Medium-Level or Growing Demand

When there is already a substantial level of *Informal Parking* that needs to be managed or when demand grows beyond the basic interventions established to deal with low-level demand, then a *Core Facility* should be established. At this stage of development, the construction of a *Bicycle Parking Facility* may have to be negotiated with the building owner or manager. In some situations, it will be appropriate to negotiate a multi-tenant solution for the whole building.

Establish a Core Facility

For sites such as train stations, major transport interchanges, workplaces and residential buildings, a *Core Facility* may take the form of a *Secure Cage*. This sort of *Bicycle Parking Facility* is designed to cater to the needs of regular users, rather than infrequent users, and requires that each user is issued with a key, PIN or swipe card.

For areas that are already inside secure buildings, *Bicycle Racks* alone may be sufficient subject to suitable shower and change facilities being available in other parts of the building. In many cases however, if cyclist numbers are significant then the facility may require a formal end of trip facility including showers, change rooms, lockers and a drying area. For shopping strips, parks and other public spaces, the transition from low-level demand to medium-level demand comes when individual *Bicycle Racks* are heavily utilised and there is a need to provide groups of *Bicycle Racks*.

Provide Visitor Parking

Workplaces and residential addresses that have a need for bicycle parking both within the walls of the building for employees/residents as well as for short-term visitors should consider the provision of visitor parking. This should generally be placed in readily-accessible areas that do not require special security access.

Balance Car Parking and Bicycle Parking

The removal of car parking to provide for bicycle parking can be contentious and should be managed carefully. Rather than removing a large number of car parking spaces when the demand for bicycle parking is not yet proven, it is best to install only a little more bicycle parking than the current demand warrants.

It may even be appropriate to initially install bicycle parking in a less-contentious space and to have the *Bicycle Parking Facilities* moved when the demand is proven. Once the demand for bicycle parking is proven, it is easy to justify the removal of car spaces in favour of bicycle parking due to the high number of bicycles that can utilise each car space.

Sometimes car parking spaces can be repurposed in a way that releases other space that was previously unreachable or dedicated to car parking space or the approach to the space.

Source Additional Space

When medium-level demand for bicycle parking is present, there is a need to accrue the necessary space to deliver appropriate *Bicycle Parking Facilities*. Some workplaces do not have any car parking or spare land. In this situation, additional space could be leased from other sites. The bicycle parking doesn't have to be in the same building as the workplace though it does have to be close by.

Plan for Expansion

Rather than build an over-sized *Bicycle Parking Facility* with significant excess capacity, it is often best to aim to cater to the current demand but to allow for additional capacity to be added as demand increases. This expansion may occur through an extension of the initial facility or by identifying locations for additional facilities.

This reactive approach may seem inefficient and costly as it requires many interventions rather than one build. Starting big does indeed save the cost of repeated interventions, however a *Bicycle Parking Facility* that is underutilised would be a poor investment. Some of these costs are financial such as the opportunity cost of the underutilised space. Others can be more symbolic such as the controversy generated by a *Bicycle Parking Facility* that is half-empty, especially when there is high unmet demand for car parking.

If an extension to the initial facility is planned, then it is a good idea to choose a site that will allow for this extension rather than incur further costs to move the facility.

In some cases, such as when demand is distributed across a large site or throughout a neighbourhood, it is preferable to provide additional core facilities rather than expand the initial facility. This approach ensures that facilities are as close to the rider's destination as possible.

Figure 92: The low cost facility on the left is about to be replaced by the more formal and higher capacity area in the background

Figure 93: Initially this cage met demand at this worksite

Figure 94: This facility was installed when demand exceeded the capacity of the facility in the previous image

5.3.4 Managing High-level Demand

High-level demand occurs when a number of factors align to produce excellent conditions for cycling, such as when the *Bicycle Network* is safe and connected, the culture is supportive of cycling and car use is not subsidised by free parking. The high-level demand for *Bicycle Parking Facilities* will overflow existing facilities and will lead to a subsequent increase in *Informal Parking* with its associated problems.

Develop a Bicycle Parking Strategy

High-level demand for bicycle parking can be expected to outgrow typical incremental growth previously experienced through the development of a comprehensive strategy to address the needs of bicycle users. Such a strategy is expected to consider all the aspects mentioned in this report.

Build Large-scale Dedicated Facilities

Workplaces, residences and campuses will need to build large, dedicated *Bicycle Parking Facilities,* while shopping strips may provide on-street *corrals* or off-street parking garages. If current facilities are poorly-located, now is the time to select a site that meets the principles described in this document under *Choosing a Location* (see p.77).

Figure 95: This bicycle corral provides parking for around 12 bicycles where only two cars were previously able to park

Provide End-of-trip Facilities

For workplaces, high-level demand is usually only achieved when the company has established a policy that seeks to maximise the number of people to ride. An essential part of this policy should be the provision of end-of-trip facilities, such as showers and lockers. Providing showers and lockers will not only serve bicycle users, but will also promote other healthy activities, such as lunchtime exercise or walking to work.

Sometimes workplaces undergo significant refurbishments to provide suitable facilities for bicycle riders. In other cases, an office move may provide the opportunity to upgrade to a location with better facilities or conditions for cycling. If none of these options are available, some organisations subsidise the membership of nearby gyms to avoid or postpone the installation of showers.

Figure 96: High quality end-of-trip facilities

Promote the Benefits of Cycling

Workplaces, local councils, building owners and others should promote the benefits of cycling through a variety of communications, such as posters and newsletters. These communications can include a range of metrics that can quantify the success of the bicycle parking strategy, in terms of participation, but also in terms of benefits to the provider and to the users. For example, it is possible to calculate the number of tons of CO_2 saved by cycling instead of driving, the number of kilojoules burnt or the total distance ridden.

Leverage User Support

A bicycle user group can be created or supported to work with local council, employers or building managers to identify issues and open lines of communication between users of the *Bicycle Parking Facilities* and the providers of the facilities.

6. Choosing a Location

It is difficult to overstate the importance of location. An excellent facility will fail if it is in the wrong location. Determining the optimum location is often where projects succeed or fail.

6.1 Principles for Bicycle Parking Locations

6.1.1 Location Principle One: Close to Destinations

A *Bicycle Parking Facility* will not be successful if it is not close to the user's destination. While a poor-quality facility will still be used if it is well-placed, even the best facility will be empty if it is not close to where people want to go.

The principle of minimising the distance to destinations is well-accepted for drivers of motor vehicles, but is even more important for bicycle users. This may seem strange given that walking and cycling are both forms of active travel, and that walking shouldn't be a problem for bicycle users. However, one of the key advantages of bicycle transport is that it is truly door-to-door, and in order to make bicycle trips competitive against other forms of travel, parking needs to be placed directly adjacent to destinations.

In some circumstances, it is appropriate or necessary to require users to walk from bicycle parking to their destination. A car-free university campus may require the rider to park at the border of a pedestrian zone. Similarly, on-street parking may be provided at the edge of a pedestrian-only retail zone.

Figure 97: This parking is poorly located and is a long way from any destination

Figure 98: Bicycle Racks located between the bicycle network and destinations

6.1.2 Location Principle Two: Prominent & Obvious

A *Bicycle Parking Facility* will be more successful if it is clearly visible to all the people arriving at a destination. A facility can reflect demand and be near the destination, but if it is hard to find, usage will not reach its full potential. A prominent location not only enables bicycle users to find the bicycle parking, but also promotes the facility and encourages more people to arrive by bicycle.

The prominence of the location is most critical for applications that attract casual visitors, such as shopping precincts. In this case it is likely that the user has not visited the destinations before and will not be familiar with the location of the parking. If formal *Bicycle Parking Facilities* are not easy to find, users will tend to park informally.

Signage alone will not compensate for an inconspicuous location. Users will tend to look for *Bicycle Racks* rather than for signs.

If a prominent location cannot be secured, the deficiency can be made up to some extent by marketing bicycle travel to users of the destination. This marketing effort is easier when the users are in homogenous groups, such as office staff, but more difficult when use is casual, infrequent and widespread across the community, such as users of a swimming pool.

Examples of suitable locations include:

- Beside the entrance to a building or railway station.
- Beside the lift in an underground carpark.
- Beside a bus stop.

Figure 99: This parking is poorly-located and is difficult to find

6.1.3 Location Principle Three: Safe for Users/Bicycles

There are a number of bicycle parking design considerations that affect the safety of users, bicycles and even the racks themselves. While the design of the parking structure and the parking layout is important, so too is the choice of location, as it affects the level of *Passive Surveillance* and exposure to motor vehicle traffic.

Choose Locations with Good Passive Surveillance

The level of *Passive Surveillance* will vary at different times. While a shopping strip may have high foot traffic during the day, there will be little *Passive Surveillance* at night. This does not mean that bicycle parking should not be located in this area, as it is likely that bicycle parking will only be utilised during trading hours when foot traffic is high.

Protect Users and Bicycles from Motor Vehicles

Parking should be sited where users, bicycles and the racks themselves will not be damaged by vehicles. The safety of users is improved through the provision of a *Bicycle Cage,* which itself provides a barrier that protects users and bicycles from errant vehicles.

Use Bicycle Cages if Necessary

Sometimes bicycle parking needs to be installed in areas that are exposed to risks. In these cases, it is important that bicycles are protected using a higher level of security than *Bicycle Racks* alone. *Bicycle Cages* are used at rail stations and have to be robust enough to withstand unfocused vandalism as well as attempts to break in.

Figure 100: This bicycle parking utilises space that was previously used for car parking

6.1.4 Location Principle Four: Pleasant Ambience

A *Bicycle Parking Facility* will be more successful if it is located in a pleasant environment that feels safe. Unattractive locations can be improved through adequate lighting and good landscaping.

Ideally, the *Bicycle Parking Facility* itself will be attractive. A brightly-painted area free of dirt and leaves will be more attractive than one that is poorly maintained. Well-maintained facilities also signal that bicycle users are valued and are important.

Abutting uses can compromise the ambience of a *Bicycle Parking Facility*. Facilities located near rubbish bins, smoking zones and other unattractive areas will suppress usage.

An unpleasant ambience will suppress usage but the opposite is not always true. Deluxe finishes and high-quality presentation may not significantly increase usage, so the additional cost may not be worth it. Especially given that industrial finishes, rather than high-quality domestic finishes, are typically appropriate.

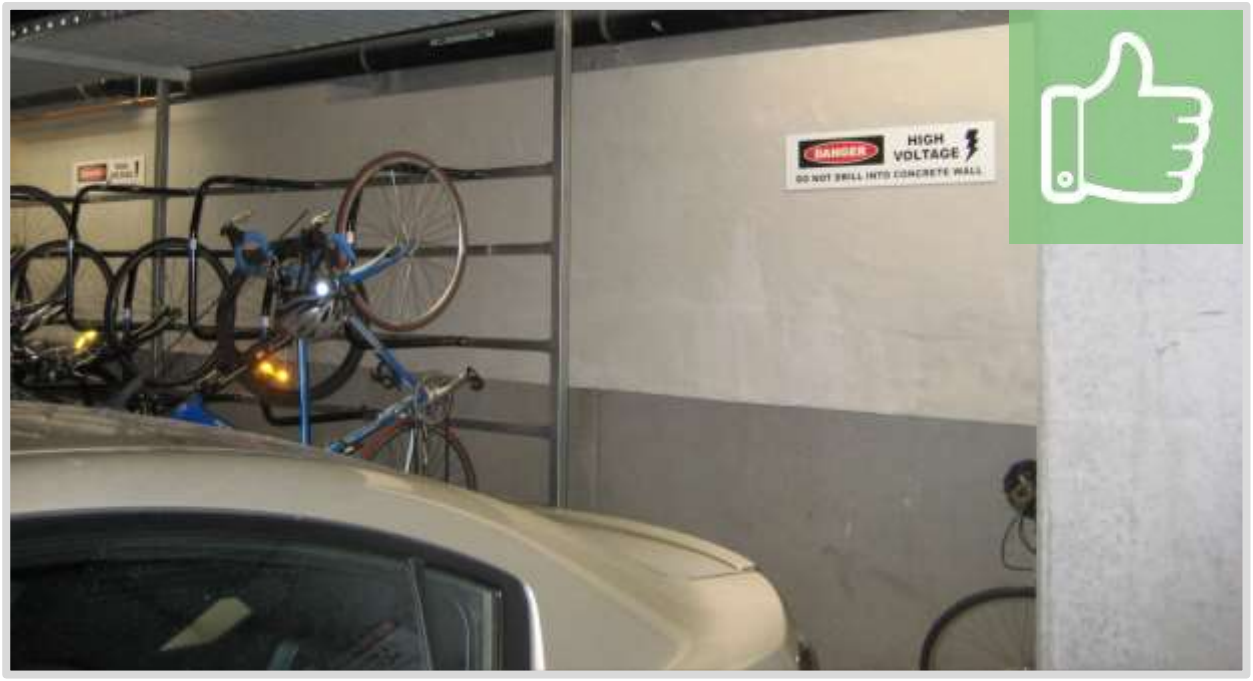
Figure 101: This parking is not only too far away from the destination but is not located in a pleasant environment

6.1.5 Location Principle Five: Compliant

Locations need to be assessed to ensure that they do not infringe on any legislative or duty of care requirements relating to the space. The following list provides some locations where care must be taken not to impact on free access to important facilities:

- Corridors
- Access ramps and steps.
- Doorways, particularly fire escapes.
- Fire extinguishers.
- Fire hydrants.
- Electrical plant and equipment.
- Garbage collection facilities.

Figure 102: The steel frame has been designed to avoid the need to penetrate the wall containing high voltage power



6.2 Steps to Determining the Optimum Location

Locations for bicycle parking often become available as part of wider changes, such as a move, new construction or a rationalisation. For example, a body corporate may review how a utility area is being used or a local government might be reviewing how certain footpaths are used. In these cases, the location of bicycle parking may not have been planned for, but seized opportunistically on the back of other changes.

The following steps can be used to determine the optimum location for a *Bicycle Parking Facility*. While it may be tempting to rush in and look for potential spaces immediately, it is important to follow the steps in the order that they have been defined. Otherwise a significant amount of time and energy can be wasted on spaces that will never be suitable.

Step 1: Assess Demand

Estimate the number of bicycles that will be parked in the facility. This step is covered in *Bicycle Parking Demand* (see p.64).

Step 2: Estimate the Parking Footprint

Use the number of bicycles identified in step one in combination with the section on *Designing Parking Layouts* (see p.93) to estimate the footprint required.

Step 3: Identify Potential Locations

Use the footprint area identified in step 2 and the section on *Choosing a Location* (see p.77) to generate a short-list of potential locations. It is important to include locations that are currently being used for other purposes, as it is unlikely that an acceptable location will be found in 'lazy space'. Suitable spaces will often already be used in some way.

Some spaces that are worth examining include:

- Spaces used for rubbish bins
- Spaces where workplaces store obsolete office furniture
- Carparks
- Lazy space on footpaths or roads

Car parking spaces for people with disabilities are often placed in good locations close to the destination. Bicycle parking could be put next to these parking spaces.

Step 4: Consult with a Small Group of Users

Discuss the merits of potential locations with a small group of bicycle users to help determine the locations that will be most effective. The users may suggest some locations that have not been considered.

It is vital to stress to the users that the discussion is about *potential* locations. This maintains flexibility for future negotiations and ensures that stakeholders do not feel that they are being presented with a final option.

Step 5: Test Short-Listed Locations

The short-listed locations must be tested to ensure that they can hold the footprint and that they meet the principles described in *Choosing a Location* (see p.77). In order to match the footprint to the space, it may be necessary to reshape either the footprint, the space or both.

A footprint area of 24m^2 can be achieved in many ways that still allow for a satisfactory *Layout,* as described in *Designing Parking Layouts* (see p.93). Rectangular shaped footprints could be: 6x4m, 4x6m, 3x8m, 8x3m and more. There are also 'L' shaped patterns that may suit unusual spaces. If changing the footprint shape is sufficient to fit the footprint into an available space without compromising the layout, then this is a simple change to make.

If reshaping the footprint is not sufficient, then sometimes the available space can be reshaped. Uncompromising items like building pillars, lift wells and access ramps are difficult to change, but there are many items that are more flexible, such as:

- Mobile items like bins
- Car parking spaces
- Plaster walls

Step 6: Communicate and Negotiate

When a number of acceptable draft locations have been identified, it is time to consult more widely with stakeholders. These could include the owner, manager, current users, abutting users of the space or other stakeholders.

Any aspect of the project, from the location, to the rack type, to the need for bicycle parking can be questioned at this time. Through negotiations it is important to emphasise that bicycle parking is a high value use of space that is likely to improve the effectiveness of the space.

It is desirable that a detailed brief is prepared that can be used to explain decisions at this point. However, if one is not available, it is important that it is clear why certain decisions have been made, otherwise the project will fail or be compromised.

Communication and negotiation skills are critical to the success of the project. The project manager must be willing to explore different solutions, but be careful not to destroy the value of the parking solution by compromising on critical requirements, such as the proximity to the destination. Different stakeholders need to be engaged and it may be necessary to lobby building managers, owners, tenants and others to achieve a satisfactory outcome.

The end of this step is reached when there is agreement to proceed with one or more of the draft locations.

7. Designing for Accessibility

Bicycle parking should be prominent and accessible to riders directly from the bicycle network in an easy, efficient, safe and comfortable manner.

7.1 Principles for Bicycle Parking Accessibility

7.1.1 Accessibility Principle One: Prominent & Obvious

Use pavement markings

The best aid to navigation is an easily 'legible' route. The legibility of the approach to the parking can be enhanced by using suitable road marking, such as green pavement and bicycle stencils. These road markings are more likely to be effective than written instructions and signage, however signage may be a worthwhile complementary measure.

Use a map in preference to text descriptions

Navigational signs that use text are an indication that the route is not obvious or legible. A clear map that shows the route to the bicycle parking is more effective.

Do not use Custom-Designed or Wordy Signage

If signage must be used, choose standard, well-recognised symbols. Unique or wordy signs are not recommended as users do not tend to read directions that are not immediately clear.

Figure 103: This sign is too complicated and will be ignored

Figure 104: This sign is simple and communicates effectively

7.1.2 Accessibility Principle Two: Easy & Efficient

A *Bicycle Parking Facility* will be more successful if it is easy to ride to. If the *Approach* to the facility is circuitous, risky or frustrating, the potential usage will be compromised. Usage will be compromised if the access route requires a high level of attention, riding skill, or if it involves walking, carrying or lifting the bicycle.

Bicycle parking should be placed close to the existing *Bicycle Network*. This ensures that bicycle users can safely and efficiently transition from the *Bicycle Network* to the *Bicycle Parking Facility* and vice-versa.

Local and state government should design the *Bicycle Network* to provide access to major destinations, such as transport interchanges, business districts and high-density residential areas. This will simplify the job of linking *Bicycle Parking Facilities* to the *Bicycle Network*.

For most providers of *Bicycle Parking Facilities*, the design of the *Bicycle Network* is out of their control, and so they should focus primarily on ensuring access to the existing *Bicycle Network*.

Figure 105: This university campus parking is provided inside the campus boundary and adjacent to the road network.

Remove Physical Obstructions

The ability to gain access to a *Bicycle Parking Facility* is affected by access path width, clutter, bollards, trees and other obstructions. The need to minimise physical obstructions on the *Approach* applies equally to all *Bicycle Parking Facilities,* whether they are on the footpath, in buildings, in parks or elsewhere.

Bicycle Racks placed on the footpath can often be difficult to reach if car parking bays are poorly laid out, or if the footpath is divided from the street by fencing or other obstructions. *Bicycle Corrals* placed on the road need bollards or other physical obstructions to reduce the danger posed by motor vehicles, but they also need to be freely-accessible to bicycle riders.

Figure 106: The access to this facility is clear of physical obstructions

Provide Sufficient Access Path Width

Access to off-street bicycle parking facilities should consist of an access path that is at least 2.0m wide for one-way movement and 2.5m wide for two-way movements, as required by AS2890.3:2015.

At times it might not be possible to provide an access path width that supports simultaneous two-way movements over its entire length. Such situations are only considered to be acceptable where there is a low number of accessing users (i.e. less than 30 movements in an hour). In such situations good sight lines between approaching users and clear signage advising of the constraint should be provided.

Minimise Distance while Dismounted

Some riders will use cycling-specific shoes which have plastic or metal cleats. These cleats provide poor stability and grip on hard surfaces, especially if the floor slopes. To minimise the risk of a rider slipping, the location of the facility and the design of the *Approach* should minimise the distance that a rider is required to walk with their bicycle.

Some building managers ask riders to dismount as they enter a carpark. These instructions are commonly ignored. Many riders will feel more comfortable and safe riding in a low-speed environment rather than walking on a concrete surface while wearing shoes with cleats, or might consider it more convenient and faster to ride into a facility.

Rather than attempting to impose impractical rules, a more effective approach is to design the facility to accommodate bicycle access that extends to the door of the *Bicycle Parking Facility*.

In terms of guidance on what is an acceptable distance for cyclists to be asked to dismount and walk their bicycle to the parking facilities, the below table is provided.

Table 4: Distance while dismounted

Distance while Dismounted		
Effective 0 – 5 m	Acceptable 5 – 30 m	Compromised Over 30 m

Figure 107: The cleats on cycling-specific shoes make it more difficult to walk, especially on sloped or uneven surfaces

Do Not Require Users to Carry Their Bicycle

Not all users will be able to carry their bicycle. Some bicycles are heavy or awkward to lift and may have panniers and other heavy attachments. Riders wearing cycling-specific shoes with cleats will find it more difficult to balance while carrying a bicycle.

Due to the above issues, designs which require a user to climb or descend stairs while carrying their bicycle are discouraged. If stairs must be tackled by the user, a wheel ramp or 'bicycle gutter' should be provided and the gradient not excessively steep.

Wheel ramps should be provided on both sides of the stairway to allow users to pass each other. The wheel channel should be spaced at approximately 400mm from a fence or wall to prevent the pedals/handlebars from catching. Additionally, care should be taken during design to ensure that the vertical grades of the wheel ramp is coordinated with the staircase, to ensure that the bicycle can be held comfortably at all times.

Guidance on what is considered to be an acceptable staircase grade with an adjacent ramp for cyclists to walk up is provided in the table below.

Table 5: Staircase gradient with wheel ramp

Staircase Gradient with Wheel Ramp		
Effective Less than 25 degrees	Acceptable 25 - 30 degrees	Compromised Over 30 degrees

Figure 108: This wheel ramp makes it easier for users to take a bicycle up or down stairs

7.1.3 Accessibility Principle Three: Safe & Comfortable

The safety and comfort of the approach to a *Bicycle Parking Facility* should be examined in detail. There are several ways to identify risks:

- Physically step (and roll) through the parking process.
- Ask users to provide feedback on how the approach can be optimised.
- Look at crash data if available.

After conducting a risk assessment, steps should be taken to improve the design of the *Approach*. Risks should be eliminated or mitigated in preference to providing warning signage.

Restrict Vehicle Speeds

If riders are approaching the parking area through or with motor vehicle traffic, it is recommended that the area be designated a *Shared Zone*. *Shared Zones* generally have a speed limit of 10kph. However, given that the average cyclist needs to travel at approximately 15km/h to maintain balance, it needs to be understood that cyclists travelling through a shared zone will likely travel at a higher speed than sign posted.

If the riders are approaching the parking area through pedestrian traffic, such as on a campus, at a public event or at public transport node, then the provider should ensure that the shared footways are wide enough to support the expected level of traffic. Refer to Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths for the appropriate specifications.

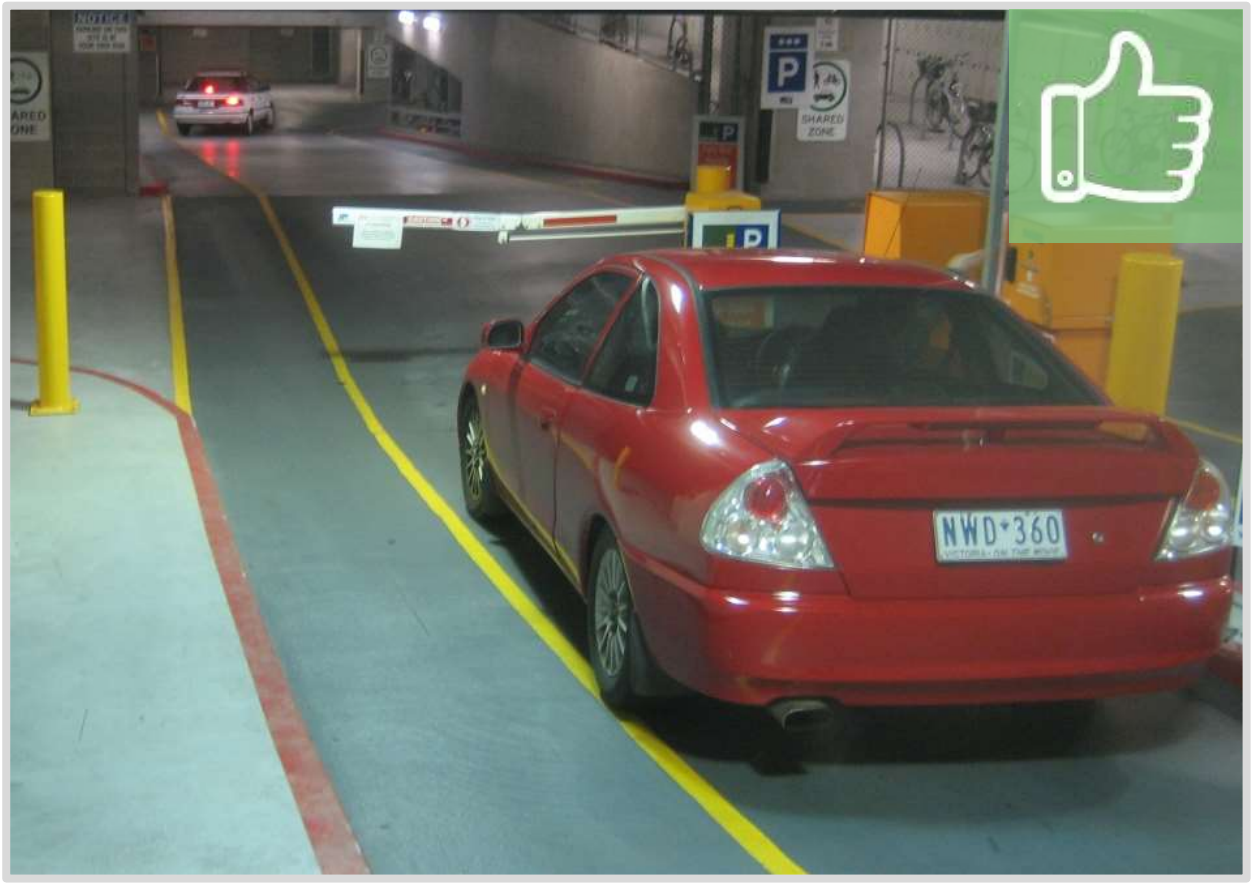
Figure 109: This pavement marking reinforces the shared nature of the parking area

Design Carefully at Car Park Control Points

Car parks, particularly those underground, are often poorly-designed for bicycle access. Boom gates are often in place to regulate motor vehicle access, however bicycle users should have an alternative path of access such as a gap beside the boom gate or a fully-separated path. Other issues also need to be considered such as the ramp gradient, non-slip ramp surface, driveway lip height, sight lines and lighting.

Figure 110: These boom gates do not permit a rider to enter or leave

Figure 111: These boom gates are designed with riders in mind



Appropriate Ramp Design

If ramps are implemented to provide access to basements or above-ground bicycle parking facilities, they should be designed with consideration for the ability of a rider. Ideally, cyclists should not be required to dismount.

Uphill ramps with a gradient of 1:5 and a length greater than 25m will exceed the capability of many bicycle users. Ideally, ramp gradients should be limited to a maximum of 1:12 for bicycle accessibility, as advised in AS2890.3:2014

Swipe card access should be located on a level surface (up to a maximum grade of 1:20) as higher grades may lead to the bicycles rolling away while cyclists are swiping their card.

Avoid using automatic bollards

Bollards that rise automatically to restrict access to motor vehicles pose a hazard to bicycle users.

Figure 112: Rising bollards can pose risks to riders

Figure 113: Here the riders have been provided with a defined bypass route. Green paint would strengthen the message

Separate Bicycles for Large Facilities

Where the volume of bicycle traffic is expected to be high or where the volume of pedestrian, car or other vehicle traffic is high, a separated bicycle access point should be considered.

Figure 114: This large facility has a dedicated bicycle entry/exit

Figure 115: This large facility has a dedicated bicycle entry/exit

8. Designing Parking Layouts

The layout of a Bicycle Parking Facility plays a large role in how easy the facility is to use. There is a tendency for parking layouts, and particularly Centre Spacing, to be too tight.

8.1 Principles for Parking Layouts

8.1.1 Layout Principle One: Adequate Aisle Clearance

A *Bicycle Parking Facility* must allow for a flow of people coming and going with and without their bicycles. The doors and corridors leading to the facility must have appropriate clearances. The design of the *Layout* must provide *Aisles* between rows of bicycles (or between a row of bicycles and a wall) that allows for users to come and go while wheeling their bicycles. While these *Aisles* take space and look terribly wasteful on plans and in an empty facility, they are essential, just as they are in car parks. The minimum recommended *Aisle* width is provided in the *Australian Standard, as follows:*

- Horizontal and vertical parking (side by side): 1.5m minimum aisle width
- Multi-tier parking or bicycle lockers: 2.0m minimum aisle width

In addition to the recommendations in the Australian Standard, designers will also want to consider whether there is a need for additional clearance if the Layout uses long rows of Bicycle Racks or if there are large tidal or peak flows. In both these cases, the high volume of users simultaneously using the space may require an aisle of greater than 2.5m to facilitate simultaneous two-way passing movements.

Figure 116: This layout shows the access aisles between the bicycle racks - additional floor racks should be provided

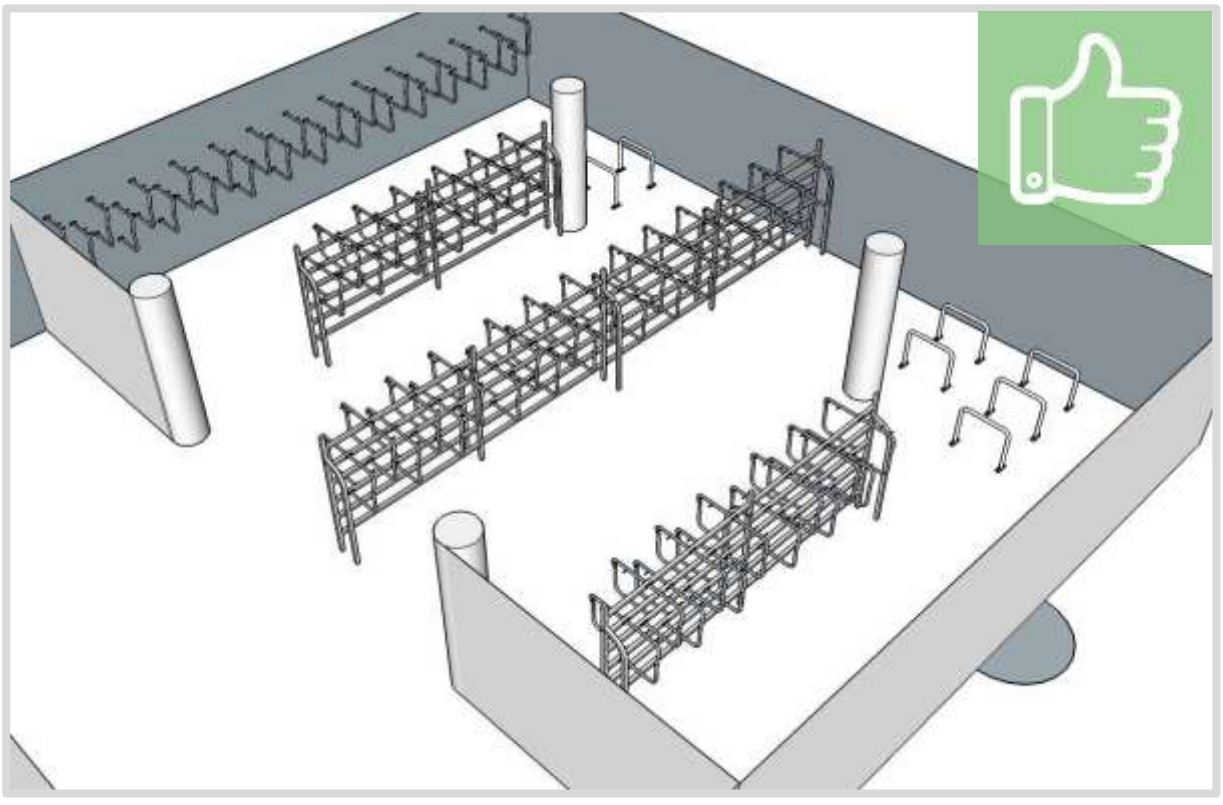


Figure 117: What looks like an excessive amount of space, proves to be necessary when bicycles are parked - additional floor racks should be provided

Figure 118: This facility provides adequate access clearance

8.1.2 Layout Principle Two: Adequate Parked Clearance

Adequate clearance must be provided between adjacent bicycles to allow the user to park the bicycle, lock the bicycle, unlock the bicycle and remove the bicycle. It should be possible to access the *Locking Zone* and to lock the frame and both wheels to the *Bicycle Rack*.

The user should be able to park their bicycle without needing to touch or move other parked bicycles. If the user is required to move other bicycles, it compromises the convenience and speed of parking and can lead to the bicycles being damaged. Also, the moving of and around other bicycles may require the user to lean and bend over in ways that can result in injury. If the racks require the bicycle to be lifted, the rider must be able to get near the centre of gravity and the lifting distance must not be excessive.

The *Layout* should use the recommended *Centres*, *Setbacks* and other measurements specified in the *Australian Standard* rather than trying to squeeze more racks into a space. The *Layout* should also not be overly generous in its spacing as this wastes space and reduces the potential for adding further *Bicycle Racks* at a later date.

Panniers, Accessories and Helmets

Once a bicycle is parked, there should be sufficient clearance between it and adjacent bicycles to allow the rider to take off accessories, collect panniers or hang their helmet off the parked bicycle. The clearance specified in this report between the centres of adjacent racks allows for adequate space for these activities.

Figure 119: Here the rider is organising their things

Locking the Bicycle to a Floor-Mounted Rack

When using a *Floor-Mounted Rack*, the *Locking Zone* is below waist height and is easily reached by someone standing beside the bicycle, but not by someone standing in front or behind the bicycle. To provide sufficient space for the user to stand beside the bicycle, the space between each adjacent *Bicycle Rack* should comply with the *Australian Standard*.

Figure 120: Here the rider locks their frame to the Bicycle Rack

Locking the Bicycle to a Wall-Mounted Rack

When using a *Wall-Mounted Rack*, the *Locking Zone* is at chest height and is easily reached by someone standing beside the bicycle. There is no need to provide additional space between adjacent racks for the user to stand as they can use the access *Aisle.* The dual use of the *Aisle* saves space but can create conflict at peak times.

8.2 Common Mistakes

8.2.1 Centre Distance Too Large

Sometimes the space available for the *Bicycle Parking Facility* exceeds the space required and there is room to provide an additional space between *Bicycle Racks*. This is not recommended as it makes it more expensive to come back at a later time and provide additional *Bicycle Racks,* and it can result in other users trying to squeeze their bicycle in between and lock them to the adjacent rail, sometimes locking both bicycles.

There are some instances where the design may be more generous than recommended in the *Australian Standard*. For example, *Bicycle Parking Facilities* that need to be designed to cope with high peak volumes may need to be more generous compared to facilities that see little use. Additional space should be allocated to increasing the width of access *Aisles* rather than on increasing the space between adjacent *Bicycle Racks*.

Figure 121: These racks are too far apart. The space could park more bicycles

8.2.2 Centre Distance Too Small

Each *Bicycle Rack* should be installed with sufficient *Centre Spacing* from adjacent racks for a bicycle to be parked and locked to each side of the rack.

Figure 122: The distance between these racks does not allow two bicycles per rack

Figure 123: These wall-mounted racks are too close together

8.2.3 Row End Spacing Too Small

The last *Bicycle Rack* in a row should be spaced far enough away from fixed objects to allow a bicycle to be parked between the rack and the object. The recommended distance is half the *Centre Spacing* defined in the *Australian Standard*.

Figure 124: Only one side of these rails can be used

Figure 125: These racks are too close together and also too close to the pillar

8.2.4 Envelope Length Too Small

Bicycle Racks should be installed to allow for a bicycle to be comfortably locked to the rack without the front or rear of the bicycle spilling into adjacent areas or hitting other objects. The required space is defined in the *Australian Standard.*

Figure 126: This setback is inadequate

8.2.5 Envelope Height Too Low

The height of the rider should be considered when installing bicycle racks. There must be enough space above the floor around all sides of the rack for the user to stand up. Failure to provide this space makes parking inconvenient and dangerous.

Figure 127: The air conditioning ducting above the rack poses a hazard to the user

8.2.6 Aisle Width Insufficient

The *Aisle* is the space behind a row of parked bicycles and must be sufficient for the passage of pedestrians and pedestrians wheeling bicycles. A common mistake is to not consider the space consumed by bicycles once they are parked on the racks.

Figure 128: This Bicycle Parking Facility has been poorly located across a pathway

9. Building and Installation

Parking structures should help protect bicycles against theft and against damage from the elements and other users. The guiding principle for structural elements should be to install them once, or provide suitable mechanisms to isolate the component to be repaired, replaced or relocated.

9.1 Anchoring the Rack

To adequately secure the bicycle, the *Bicycle Rack* itself must be securely anchored to the surrounding structures. A *Bicycle Rack* will often be subject to significant load, particularly if targeted by vandals. Vandalism can damage racks that are not well secured or if the mounting surface lacks structural integrity.

Any force applied to the top of a *Floor-Mounted Rack* will be magnified at the base and has the potential to dislodge bolts or concrete mountings. Day-to-day wear and tear can also take its toll and work fixtures loose.

There are a number of effective anchoring techniques including:

- Setting in concrete.
- Wedge anchors or expansion bolts.
- Chemical anchors.

Setting the rack in concrete provides good strength and is especially useful in situations where there is not an existing concrete surface to provide the required structural integrity. Setting the rack in concrete is a permanent solution that makes future repair, replacement or relocation more expensive. Wedge anchors and expansion bolts are a useful technique but can come loose over time or break free of poor concrete. Chemical anchors embed a steel bolt in a two-part resin that hardens when the two parts are combined. Chemical anchors are suitable for masonry walls and other materials that are not as strong as concrete.

Figure 129: This bicycle rack has been levered out of the concrete

Figure 130: The gravel surface has been insufficient to secure the rack footing

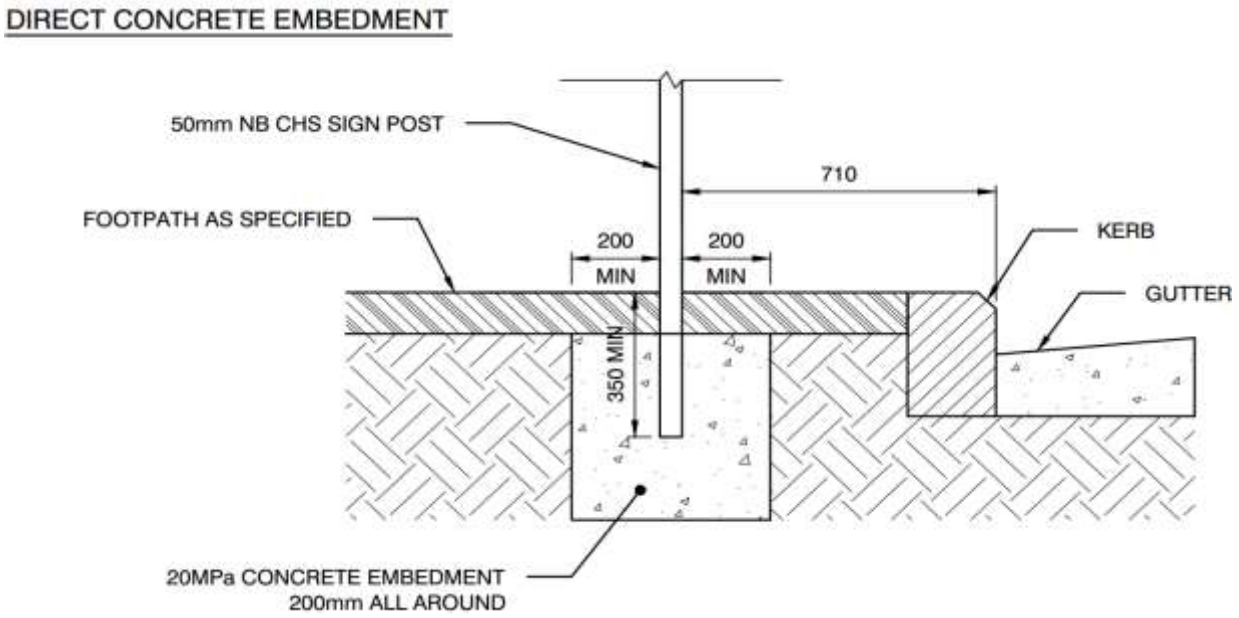
Figure 131: One of these bicycle racks has been removed by vandals

Figure 132: The small concrete footings have not adequately secured the Bicycle Rack

9.1.1 Concrete Anchors

Bicycle Racks that are installed in an asphalt, tile or paver base will need to have each foot mounted in a concrete embedment before the top layer of asphalt, tiles or pavers is applied. Each jurisdiction is likely to provide the requirements for a concrete embedment.

Figure 133: This technical note shows the required direct concrete embedment for a sign post or bicycle rack



Source: City of Sydney

Figure 134: Bicycle racks installed in a hard, paved surface

9.1.2 Metal Fixtures

The fasteners used to fix *Bicycle Racks* needs to take into account what type of material the rack is made from. Incompatible fasteners may dramatically increase the corrosion of either the rack or fastener through galvanic action. Galvanic action occurs when two dissimilar metals come into electrical contact with a conductive electrolyte, usually rainwater or groundwater. One of the metals will ultimately corrode at an increased rate.

Best practise is to use fasteners made from the same material as the racks. For example: galvanised racks should use galvanised fasteners; 304 stainless racks should use 304 stainless fasteners.

Figure 135: The foot of this bicycle rack has rusted due to galvanic action between the bolts and the rack

9.2 Floors

9.2.1 Surface

The floor of a *Bicycle Parking Facility* should be a hard surface such as concrete, asphalt or pavers. Loose or dusty surfaces such as gravel, grass or recycled concrete do not always hold the bicycle still and can result in dirt affecting the moving parts of the bicycle or being tracked away from the facility. Grass can become worn by constant bicycle and foot traffic or turn muddy.

Figure 136: This loose surface can become untidy over time

Figure 137: This grass surface has become worn

9.2.2 Platforms

The area beneath the *Bicycle Rack* should be designed to provide level access (up to a maximum of 1:20 as required by the Australian Standard). Concrete platforms present a trip hazard and can fail to keep the bicycle level if they are too small.

Figure 138: This bicycle rack is securely mounted in asphalt that provides a smooth and consistent surface

Figure 139: The area beneath this rack is raised and presents a trip hazard

9.3 Roof or Canopy

Bicycle Parking Facilities in Northern Europe commonly provide a simple roof or canopy (without walls) to shelter bicycles and users from rain and snow. This is a low-cost way of providing not only shelter, but also a structure that can be used to attach a map and advertising banners. As long as theft or damage is not a problem, there is no need for walls, doors and locks which make up a large part of the overall cost of a parking structure.

A roof or canopy can be an inexpensive way of turning an otherwise unused space into a useful *Bicycle Parking Facility*. This is significantly cheaper than providing space inside a building and may suit certain circumstances.

Figure 140: This simple and cheap canopy provides shelter to bicycles and riders

9.4 Walls

Walls may be used simply as a structure to support *Wall-Mounted Racks* or they can form part of a larger, secure *Bicycle Parking Facility.* Even for non-secure *Bicycle Parking Facilities,* such as a three-sided box, the additional space-utilisation afforded by *Wall-Mounted Racks* is well-worth exploring. The increased space-utilisation of *Wall-Mounted Racks* may prove the difference between being able to find enough space for a row of parking or not.

9.4.1 Existing Walls

If the chosen location already has suitable walls, then it may be possible to achieve significant savings by utilising these walls rather than building a completely custom *Bicycle Parking Facility*. Underground car parking facilities often have spaces where a secure *Bicycle Cage* can easily be built with the addition of one or two walls as shown in Figure 142.

Existing walls that do not have sufficient structural strength to support *Wall-Mounted Racks* can be strengthened by the addition of a metal frame wall as shown in Figure 143.

Figure 141: Here the parking is on the perimeter wall between the pillars

Figure 142: The addition of this metal frame wall is all that was needed to create the bicycle cage needed to secure this bicycle parking facility

Figure 143: This wall required the installation of a metal frame on which the hangers could be fixed

9.4.2 Perimeter Walls

Walls that are constructed as part of the perimeter of a *Bicycle Parking Facility* should generally utilise a mesh or similar material that allows for the free flow of light and fresh air. The mesh allows users to see inside the facility and improves *Passive Surveillance* by allowing people to see inside the facility. This improves both personal safety and the safety of bicycles.

Perhaps counter intuitively, a mesh wall will reduce the chance of thieves breaking in as they can see what is inside. The possibility will usually seem more valuable than the reality. However, the strength of the mesh fence should be sufficient to prevent easy access by a potential thief and/or to support any ranks being mounted to them.

Figure 144: This mesh provides air flow and passive surveillance

9.4.3 Internal Walls

Internal walls can be built within the perimeter of a *Bicycle Parking Facility* to provide additional space for *Wall-Mounted Racks*. One metal frame wall can provide support for bicycles on both sides and can be built relatively cheaply.

Figure 145: This false wall allows more bicycles to be parked than on the perimeter wall

9.5 Buffers

When the parking area is adjacent to other facilities, including car parking and rubbish collection areas, it may be appropriate to install buffers such as kerbs or bollards to protect the area from intrusions that may damage the structures, bicycles or users. This should only be used in the instance that it does not create unnecessary street clutter or tripping hazard. Damage to the fence or structure may be just as big a maintenance issue as damage to the bicycle parking installation.

If motor vehicles are moving near the facility, standard warning signs such as chevron boards may be appropriate. In some locations, temporary buffers and warnings for an initial period may be all that is necessary.

Figure 146: These rails have been damaged by a motor vehicle

Figure 147: The fence buffers the bicycle parking from the car parking

Figure 148: Chevron board alerts drivers to the presence of parked bicycles

9.6 Doors and Gates

Doors and gates provide a significant barrier to the theft of bicycles. Even a *Bicycle Parking Facility* with no lock on the door will be more secure with a fence and a gate than without. A facility without a roof will be somewhat vulnerable to theft but will still benefit from having a fence. The level of security can be improved by providing good lighting and CCTV cameras.

9.6.1 Automatic Opening

It can be difficult to manage a spring loaded door while holding and wheeling a bicycle. This is made more complex if the user is also handling their swipe card or other access device. Ideally the door to the facility will open automatically when the user presents a swipe card.

9.6.2 Automatic Closing

The security of a Bicycle Cage can be compromised if by users are lazy or careless and forget to close/lock the door. The door should close and lock automatically either through the use of a spring-loaded door or using a motor.

9.6.3 Sliding Rather Than Swinging

Doors can be hung to swing outward or inward depending on the space available. Doors that swing outward provide more space inside the enclosure but increase the risk of collisions outside the facility as users exit the facility. Ideally the door will slide along a wall or roll up like a garage door eliminating the problems of a swinging door.

9.6.4 Door Width

Bicycle Parking Facilities that are provided inside buildings should be accessed through doors that are significantly wider than a standard doorway. Any door used by riders who are walking with their bicycle needs to be wide enough to allow at least one person and their bicycle to easily pass through the door. While it is important that *Corridors* are wide enough for two riders to walk past each other with their bicycles, doors do not need to be this wide unless the facility sees very high levels of usage.

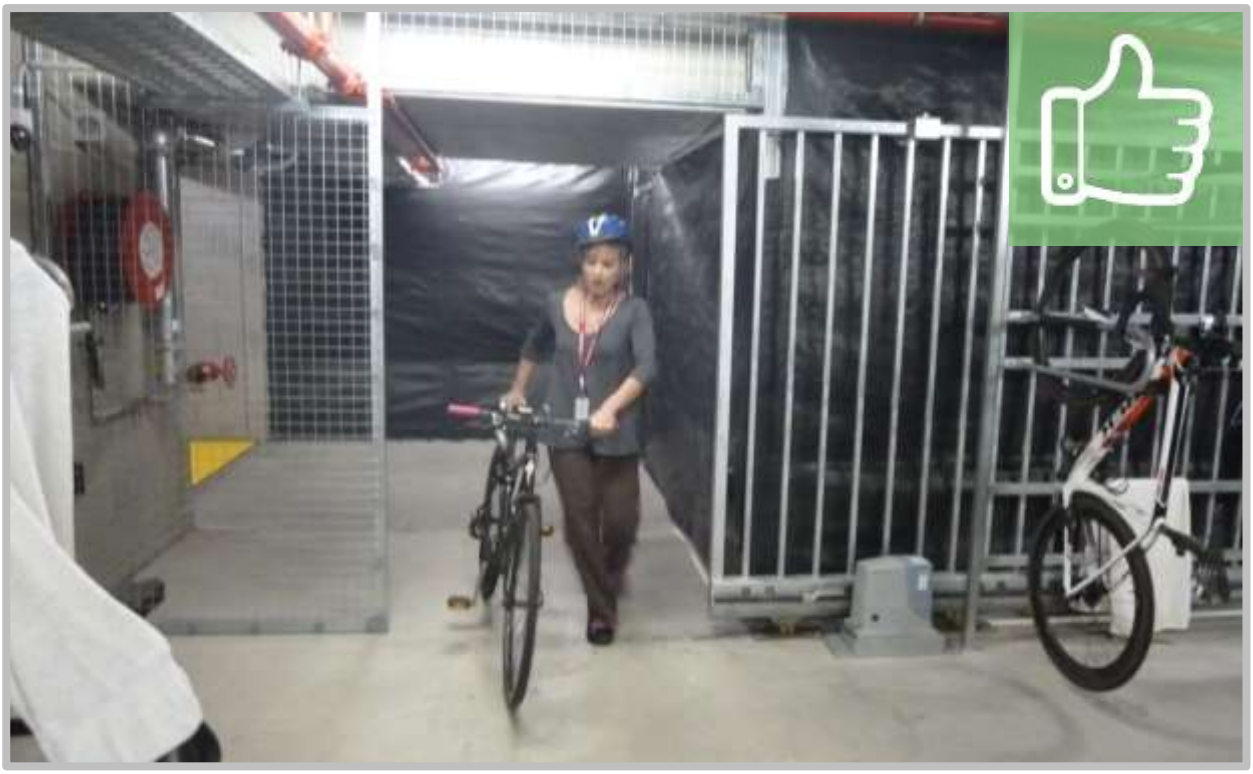
Guidance on what door widths are acceptable for low use bicycle parking facilities (i.e. 30 cycle movements in an hour) is provided in the below table.

Table 6: Door width for access to bicycle parking

Door Width for Access to Bicycle Parking		
Effective Over 1.5 m	Acceptable 1.2 – 1.5 m	Compromised Under 1.2 m

Figure 149: This door is transparent, automatic, secure and sliding

Figure 150: This door operates automatically on presentation of a swipe card and provides sufficient space for a rider to walk their bicycle



9.7 Locks and Access

Doors can be locked through a variety of mechanisms, such as keys, PIN codes, swipe cards and staff passes.

A lock that uses a key is not recommended for the following reasons:

- Keys are easy to copy.
- It is costly to replace the lock barrel in the event of a lost/stolen key.
- Access cannot be denied temporarily or permanently to selected people.
- Keys are more difficult to administrate than electronic systems.

Padlocks are a particularly poor choice of locking mechanism as they not only have the disadvantages of a keyed system, they are also clumsy to use and require both hands. PIN systems are superior to keys, however, the best approach is to use chip or RFID systems such as swipe cards and staff passes.

Electronic forms of access not only provide secure access to the *Bicycle Parking Facility* but also gather information on usage rates. The fact that users are individually-monitored increases the level of security significantly as there is a feeling that any theft can be tracked to a particular user.

Electronic access systems provide the data required to perform various calculations such as the return on investment for the facility. Workplaces who wish to reward staff who cycle can use this data to, for example, give a special bonus to people who have ridden for more than 100 days in a year.

Figure 151: The PIN system on the left is better than a padlock or key based system. The card reader on the right is the best approach

9.8 Corridors

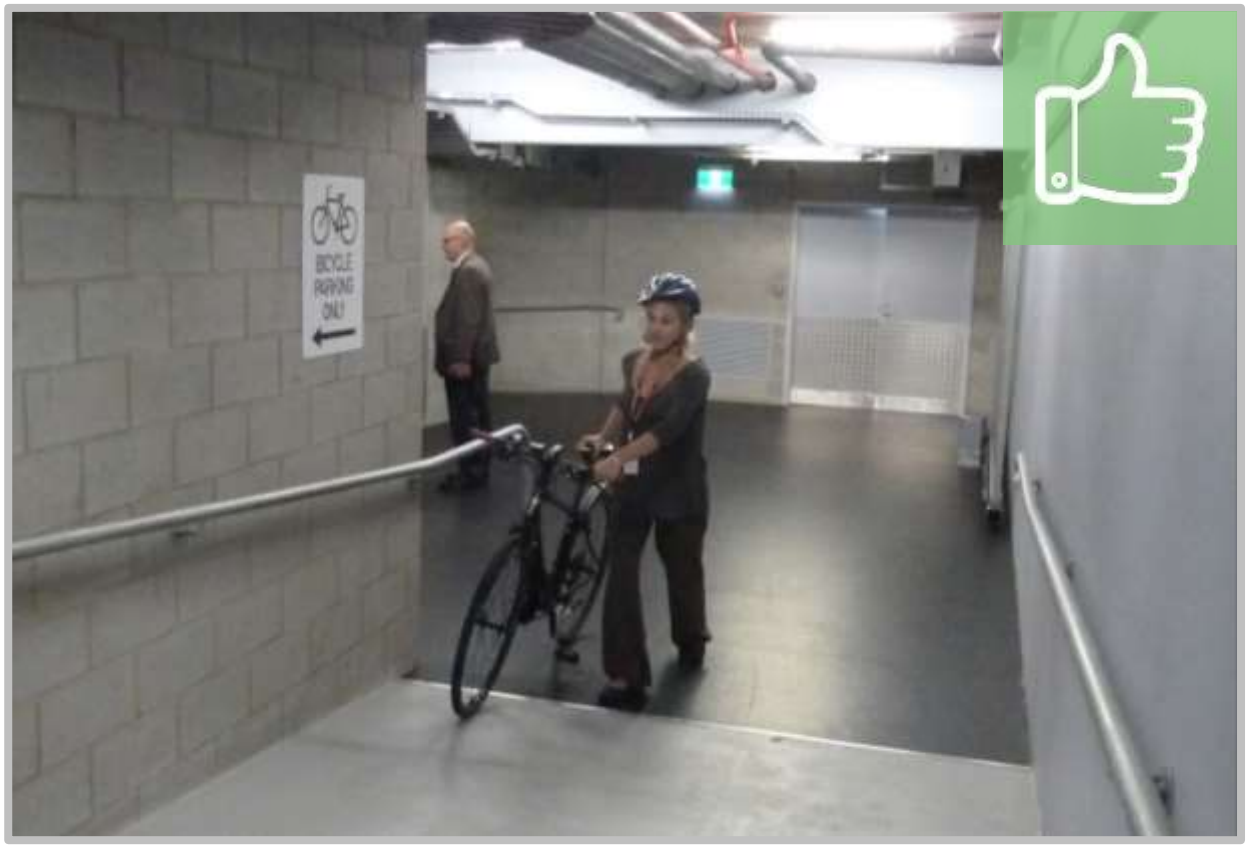
Bicycle Parking Facilities that are provided inside buildings should be accessed through *Corridors* that are wide enough for two users to walk past each other while pushing their bicycle beside them. For locations where the flow of users is primarily in one direction (i.e. arriving in the morning and leaving in the afternoon), it is not as critical to provide a full 2.5m *Corridor*. The *Australian Standard* recommends a *Corridor* of at least 2.0m in these cases, or 2.5m for accommodating simultaneous two-way flow.

Guidance on suitable corridor widths is provided in the below table.

Table 7: Corridor width for access to bicycle parking

Corridor Width for Access to Bicycle Parking			
Effective (Two-way) Minimum 2.5m	Effective (One-way) Over 2.0 m	Acceptable 1.5 – 2.0 m	Compromised Under 1.2 m

Figure 152: This corridor provides sufficient space for two riders to pass each other while walking their bicycles



9.9 Lighting

Lighting can play an important role in the usability and security of a *Bicycle Parking Facility* and should always be considered during the design process. In cases where the facility is likely to be accessed at night, such as in a strip of restaurants, it is especially critical to provide adequate lighting.

The first stage of the design process is to consider whether existing lighting is adequate. On-street *Bicycle Parking Facilities* can be placed close to existing street lighting to save money. Bicycle parking in an underground car park may already be supplied with adequate lighting.

In cases where existing lighting is not adequate, the design should consider how to provide lighting both inside the area of the *Bicycle Parking Facility* and also over the *Approach*.

Figure 153: This bicycle path and bicycle parking facility have been lit in a creative and pleasant way that adds to the aesthetic quality of the facility

9.10 Electrical and Data Facilities

9.10.1 Surveillance and Access Systems

Bicycle Parking Facilities with cameras, smart card access or lighting will need power. Sometimes this can be provided by a standalone solar and battery system, otherwise the project will need to include a connection to the electricity network.

Bicycle Parking Facilities with electronic access provisions such as swipe-card access will need access to data networks. Depending on the facility, access to the network may be provided through a wired or wireless connection.

Security cameras are sometimes included in parking projects. If the area, campus or workplace has an existing system, it is usually relatively straightforward to add cameras to the established system.

Figure 154: This caged area has no roof but is 'patrolled' by CCTV cameras

9.10.2 Charging of Electric Bicycles

Electric bicycles are increasingly being used as a means to overcome some of the barriers to cycling. By reducing the effort required to travel by bicycle, electric bicycles make cycling more accessible to people of all ages, those who cycle through hilly terrain or those who don't want to "work up a sweat".

To support the use of electric bicycles, the design of Bicycle Parking Facilities may include access to power sockets in close proximity to at least some racks. Due to the additional weight of electric bicycles in comparison to regular bicycles, it is advisable to provide charging facilities close to Floor Mounted Racks and to mark these racks for "Electric bicycles only".

As electric bicycles use a variety of chargers and socket types, the provision of a General Purpose Outlet is recommended for public installations. For fleet installations, it may be possible to provide dedicated cables with plugs that are compatible with the sockets for that fleet (as shown below).

Figure 155: This company's electrical bicycle fleet is supported by dedicated charging facilities

10. Providing Amenities

Amenities such as showers and lockers are important in workplaces and can have an effect on the level of utilisation of bicycle parking facilities, as well as other externalities like staff retention levels.

10.1 Designing Buildings with Amenities

It is important that buildings with amenities are laid out in a way that makes the standard sequence of tasks quick and easy to perform. If the showers and *Bicycle Parking Facilities* are in the basement, but the lockers are on the ground floor, users will need to pass back and forth between different floors multiple times. This makes the process time-consuming and inconvenient.

The sequence of tasks will be affected by the design of the facilities. If each shower includes a changing area, then each shower can be used by both men and women. In this case, users will take their clothes with them to the shower.

If each shower does not include a changing area, then users will need to get changed at their lockers. In this case, showers and lockers would need to be adjacent and would need to be for single-sex use only. This may result in lower utilisation of showers and lockers as one set may be full while the other is not.

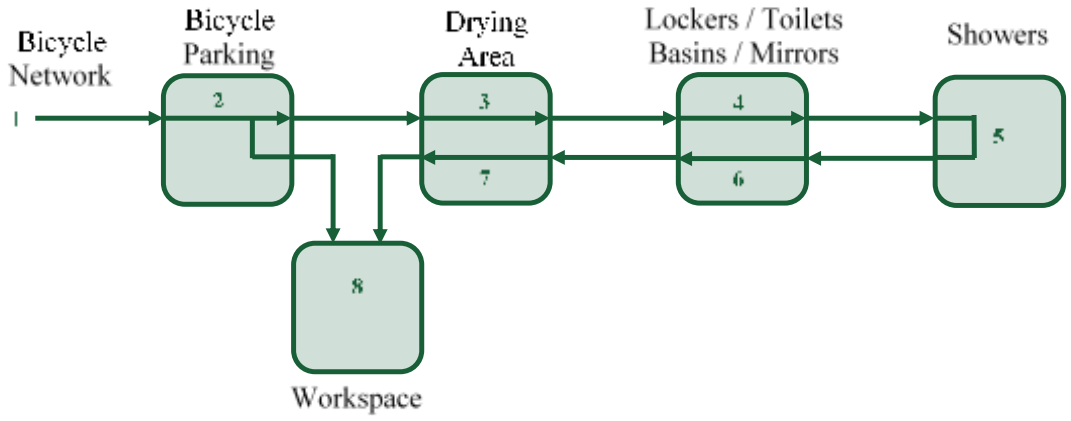
10.1.1 Arriving at Work

The typical steps involved in arriving and preparing for work are:

1. Arrive at workplace and navigate to Bicycle Parking Facility (with bicycle).
2. Park and lock bicycle. Optionally remove accessories such as lights, bags and helmet from bicycle.

   Users who don't shower or change will proceed to step 8.
3. Retrieve towel from drying area or towel cupboard.
4. Retrieve work clothes/toiletries from locker and store bicycle accessories.
5. Have shower. Use towel to get dry. Change into clothes.
6. Do hair/makeup etc. Store toiletries and dry clothes/shoes in locker.
7. Hang up wet towel and wet clothes/shoes in drying area.
8. Enter workspace.

Figure 156: Example workflow for arriving at work

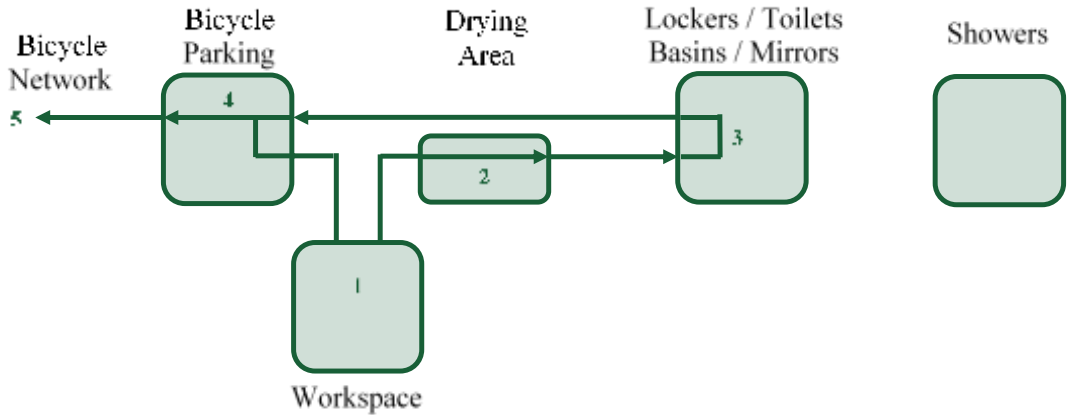


10.1.2 Leaving Work

The typical steps involved in leaving work are:

1. Leave workspace.
   Users who don't shower or change will proceed to step 4.
2. Collect any cycling clothes/shoes that are drying.
3. Get other cycling clothes/shows out of locker and get changed. Store work clothes in locker (or take them home). Remove accessories from locker.
4. Unlock bicycle and attach accessories to bicycle.
5. Leave workplace.

Figure 157: Example workflow for leaving work



10.2 Showers

10.2.1 Determining if Showers are Required

Showers are a very important component of a workplace *Bicycle Parking Facility* and enable a greater diversity of commuting trips to be made by bicycle. For example, trips made on hot days or during rain will usually require the rider to have a shower. Also, bicycle trips over hilly terrain or over longer distances will also require the rider to have a shower. Shower and change facilities are also often used by those who exercise around work hours and other active travel commuters.

Riders who make short trips to destinations such as local shops do not need showers or lockers. Recreational riders will generally shower at home. Most public transport users would not look to shower at a transport node as the majority of riders accessing public transport tend to only ride a few kilometres and can do so in normal clothes rather than cycle-specific clothing. There may be a small portion who ride for some distance to access a transport node, but people willing to make longer journeys by bicycle are more likely to ride to their eventual destination if possible.

10.2.2 Managing the Demand for Showers

Unfortunately, showers are very expensive and can cost more than any other part of the facility. To minimise costs, the first step should be to identify existing showers that can be used by riders. Then as demand grows, a more comprehensive shower facility will need to be provided.

The demand for showers is heavily concentrated in the morning peak, although there is sometimes demand during the lunch period. In most offices where people start at around the same time, most people will want to use the showers at the same time. The more showers that are provided, the faster the throughput will be and the lower the frustrations of the users.

To get the best utilisation of shower resources, a number of techniques can be used to spread or reduce demand:

- Showers can be fitted with timed taps that cut the water off after a set time period to encourage short showers.
- In lower utilization scenarios, to ensure that all showers are being used, the shower and locker area can be shared by both men and women, with a change space inside the shower cubicle. It is often preferable, however, to separate sexes where possible for personal comfort.

10.3 Workspace and Tools

10.3.1 Self-Serve Bicycle Repairs

A bicycle workshop space within a *Bicycle Parking Facility* allows riders to fix a puncture or other small mechanical problem and to wash up afterwards. Riders appreciate the provision of a workshop space that ensures that they are not required to work on their bicycle in an awkward space such as a corridor. A bicycle workshop should include a work stand, a floor pump, basic tools, hand cleaner and so on. Some workplaces even provide spare tubes.

10.3.2 Full-Service Bicycle Repairs

A space that has been provided for bicycle repairs could be used by a visiting mechanic to service bicycles while staff are at work. An excellent way for a workplace to promote cycling is to employ a bicycle mechanic on a short contract or on a monthly contract to perform repairs on the bicycles of employees. This is relatively inexpensive and can lead to mode shift as new riders seek to get their old bicycles roadworthy.

10.3.3 Bicycle Maintenance Courses

A space that has been provided for bicycle repairs could also be used for in-house classes to teach employees basic bicycle maintenance skills.

Figure 158: A bicycle work stand, work bench and basin

10.4 Clothes Lockers

10.4.1 Determining if Lockers are Required

Clothes lockers allow people to keep a change of clothes (or several sets) at work so that they can change out of their cycling attire when they reach work. Some people carry their spare set of clothes with them every day. Some people bring in a week's worth of work attire on the weekend. Some people commute by another means on one day and carry several days of clothes to store in their locker for other days.

Clothes lockers, like showers, are not required by all riders or for all types of trips. Lockers should be provided in workplaces to support people who don't like to work in the clothes that they rode in.

10.4.2 Managing Demand for Lockers

Lockers can be used by not only bicycle riders, but also by staff who wish to store a spare set of clothes at work for whatever reason. They may go for a run at lunch time or may like to keep a set of clothes ready in case after-work plans arise.

It is a good idea to gauge demand by asking for registrations for lockers in advance of designing the facility. Clothes lockers, particularly if they are free, often prove to be very popular. Space should also be reserved to allow for more lockers to be added when needed. If the demand for lockers outstrips supply, it may be necessary to instigate a policy that all lockers are vacated at the end of the week (or day).

Figure 159: This is a high quality end-of-trip facility

10.4.3 Shape and Size of Locker

Square ‘gym’ lockers are not appropriate. Vertical lockers are preferable as they allow clothes to be hung.

Figure 160: These lockers are unsuitable as they don’t accommodate a hanging space

Figure 161: These lockers are suitable

Figure 162: This locker is too shallow to comfortably hold a suit coat on the hanger

10.5 Ventilation and Drying

10.5.1 Clothes and Shoes

Workplace *Bicycle Parking Facilities* usually need to provide for ventilation, as well as areas for drying wet or dirty clothing. The facility needs to be ventilated to allow clothes and, in particular, shoes to air. Riders will avoid riding on wet days if they cannot dry their rain jackets and shoes, or on hot days if they continue to sweat after they have showered and put their work clothes on. Ventilation/drying areas are also very important for hygiene an amenity of the Bicycle Parking Facility.

Passive ventilation or the standard air-conditioning may not be enough to adequately dry sweaty or wet clothes and shoes. Best-practice facilities will install a special-purpose drying room.

Attention needs to be paid to the drying racks. Some facilities rely on informal systems where riders hang shoes and drape coats over bicycles and other protrusions. This can work on a small scale but not for medium to large facilities.

Figure 163: Riders will tend to store their shoes outside the lockers

10.5.2 Towels

When the facility has showers, towels will need to be dried. Towels hung in lockers will not dry and so they are often hung wherever there is space. In these situations, a formal system of drying racks needs to be installed. Workplaces should also consider providing a towel service as described later in this document.

Figure 164: The fan is intended to boost the air condition system

Figure 165: Drying space and racking has not been provided in this facility

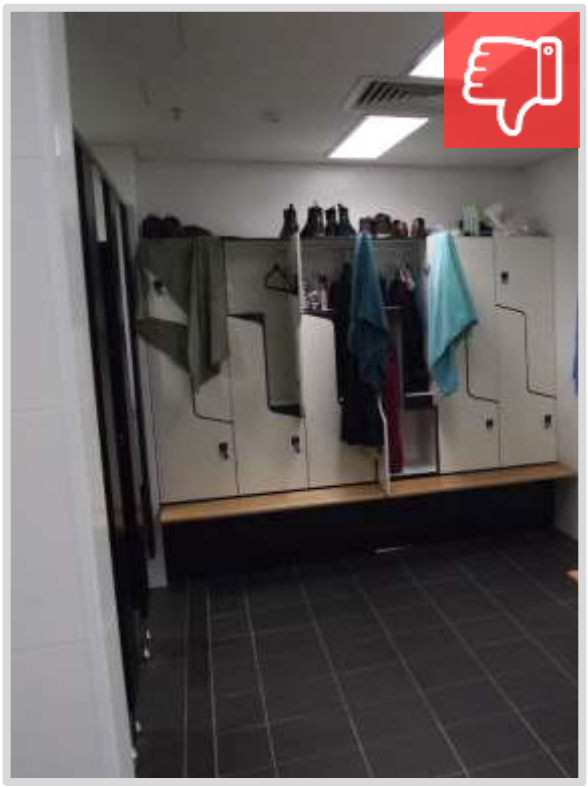


Figure 166: A large domestic washing line is used to dry the riders' towels

11. Operating and Maintaining Facilities

To achieve the best results from an investment in bicycle parking, there are a number of administrative responsibilities that should be covered after the facility is opened.

11.1 Enforcement

11.1.1 Safety Management

The most common safety problem that the manager of a *Bicycle Parking Facility* needs to manage occurs on the *Approach* to the *Bicycle Parking Facility*. For most on-street *Bicycle Parking Facilities*, the *Approach* is little more than the gutter between the road and the *Bicycle Racks*. In other environments the *Approach* may involve complex interactions between motor vehicles, bicycles and pedestrians.

A common approach to dealing with safety concerns that involve bicycles is to order riders to dismount. While this approach seems quick and simple, it is rarely effective, especially when the order to dismount does not align with the signals given by the built environment.

For example, ordering bicycle users to dismount as they enter a car park is likely to be ignored as it conflicts with the rider's understanding that they have the same rights as a motor vehicle. However, as a bicycle user approaches the area where pedestrians enter a destination, bicycle users will dismount of their own accord.

A sensible approach to signage is to reinforce the need to take care, and dismount when sensible, through signage such as the "Shared Zone" sign below.

Consideration should be given to how the design of the *Approach* to a *Bicycle Parking Facility* communicates to a bicycle user. It should be clear where to dismount from the design rather than through the addition of "Cyclist Dismount" or similar signage.

Figure 167: Signage that is not consistent with the built environment will be ignored

11.1.2 Bicycle Removal

Bicycles need to be removed from *Bicycle Parking Facilities* if they are deemed to be abandoned. Deciding on what period of time to wait before declaring that a bicycle is abandoned should depend on the normal usage patterns of the *Bicycle Parking Facility*. Bicycles that are removed should be stored for some time before disposal.

Identifying Abandoned Bicycles

The best way to determine whether a bicycle is abandoned is to 'tag' the bicycle. This is done by tying a loop around the wheel and frame that warns the user that the bicycle will be removed on a particular date (usually one week from the time of tagging). The loop should be easy to remove by the user or should break if the bicycle is ridden. The loop should also be robust enough to stay on the bicycle if the bicycle is not collected by the user. Users can also be encouraged to report abandoned bicycles by phone or email.

Warning Users

It is a good idea to warn users that bicycles may be removed if they are left for more than a set period. A sign at the entrance or close to the *Bicycle Parking Facility* can alert users to their obligation to remove their bicycle and not to use the facility as bicycle storage (unless that is its purpose). For facilities where users 'sign up', such as *Bicycle Cages*, the terms and conditions can include the right for the facility manager to remove bicycles that have remained for more than a set period.

Tools and Training Required

When a bicycle is to be removed, large bolt cutters or an angle grinder will be required. Occupational health and safety requirements will need to be considered in the use of these tools.

Figure 168: Tagging of derelict vehicles

Figure 169: Tagging of derelict bicycles

11.2 Financial Management

11.2.1 User Fees

Bicycle Parking Facilities cost money to construct and operate, so there is a tendency to look at ways of recouping that cost through user fees. However, this tendency does not seem as strong for car parking, with many businesses, train stations and workplaces providing free car parking due to its perceived 'necessity'. There is no sensible reason why bicycle parking should be disadvantaged compared to car parking. In fact, there are many reasons why bicycle parking should be encouraged as outlined earlier in this report.

There are a number of reasons why charging for the use of *Bicycle Parking Facilities* is rarely a good idea:

- Demand will be suppressed and the benefits described earlier in this document will be lost.
- Car use will increase, resulting in greater congestion, increased noise, increased pollution, greater danger and less space for parking.
- There will be an increase in *Informal Parking.*
- The cost of collecting fees makes the net revenue very small.

Charging fees however may be appropriate when the fees go towards providing a high degree of service such as the supply of fresh towels daily.

11.2.2 Financial Incentives

As outlined earlier in this report, there are many reasons why people should be encouraged to ride bicycles, especially when these trips replace car trips. As many of these benefits are captured by the provider of the bicycle parking, they have a strong incentive to encourage bicycle use.

It is difficult in some circumstances to create systems that reward users financially. Financial incentives are easier to arrange where the users are known to the provider as for workplaces or for *Bicycle Cages* that have secure access.

Workplaces could offer cash payments to employees who forgo employee car parking entitlements. Residential buildings could sell parking spaces on separate titles to allow buyers to choose to save the cost of a car space. Public transport operators could provide discount travel to users who park their bicycle in a *Bicycle Cage*.

A British employer, GlaxoSmithKline, decided to pay those willing to forgo a car space and ride to work £400 p.a. rather than pay the car parking provider £2,000 p.a. per space. Ridership rose from 1% of staff to 10%.

11.3 Services

11.3.1 Towel and Laundry Services

Providing 'red carpet treatment' makes riding to work a more pleasant and convenient experience and encourages bicycle use. Workplaces who offer fresh towels or free laundry services not only encourage bicycle use, but also ensure that the facility is not cluttered by towels.

11.3.2 Cleaning

Cleaning includes rubbish removal, sweeping and graffiti removal. Those responsible for these duties should be explicitly tasked with the care of the facility.

11.3.3 Repairs

From time to time repairs will need to be made to the parking structure, locks, racks and other physical features. This needs to be anticipated and those with the responsibility alerted. A phone number or email address that reaches the person responsible for repairs should be provided to users through signage on the *Bicycle Parking Facility*.

11.4 Security and Access

11.4.1 Access coordination

Any *Bicycle Parking Facility* that has a lock will need someone to coordinate access, enrol new users and disconnect users who stop using the facility. Any facility that has clothes lockers will need a similar process to manage the lockers.

It is strongly recommended that both are accessed through a fully refundable deposit system. The deposit system ensures that the access and locker remains in the hands of active users. Identifying which users are still active and which lockers are no longer being used is extremely difficult and time consuming without a deposit system.

In some instances, access is unnecessarily restricted to the same number of persons as there are bicycle parking spaces. This can limit effectiveness as it is unlikely that on a given day, all users will all ride. It also has a tendency to rule out casual riders who may be denied access due to a perceived shortage of bicycle parking.

11.4.2 Surveillance

The design of a *Bicycle Parking Facility* should aim to make active surveillance such as security guards unnecessary. The materials should be robust enough to survive most attempts at vandalism or theft. *Passive Surveillance* should be optimised by placing the facility near areas of high pedestrian activity.

Further surveillance can also be supplied through the use of CCTV cameras. Cameras are most effective when the users of the *Bicycle Parking Facility* are already known such as at a workplace or for users of a secure *Bicycle Cage*.

12. Further Reading

- **Australian Standard AS 2890.3:2015 – Parking facilities - Bicycle parking**

  This standard forms the underlying standard that all bicycle parking facilities should meet and should be read in conjunction with this report. [http://infostore.saiglobal.com/store/details.aspx?ProductID=1818478 accessed 21.9.2016]

- **Comprehensive guides to bicycle parking**

  These guides go into considerable detail on all aspects of bicycle parking. For example:

  – *The Bicycle Parking Guidelines* 2nd Edition (Association of Pedestrian and Bicycle Professionals 2010) [http://www.apbp.org/?page=publications accessed 21.9.2016]

  – *Bicycle End-of-Trip Facilities: A Guide for Canadian Municipalities and Employers* (Transport Canada 2010) [https://www.fcm.ca/Documents/tools/GMF/Transport_Canada/BikeEndofTrip_EN.pdf accessed 21.9.2016]

- **Local guides to bicycle parking**

  These guides are written by local authorities and agencies. For example:

  – *ARTA Guidance Note for Cycle Parking Facilities 2007* (Auckland Regional Transport Authority 2007) [https://can.org.nz/system/files/arta%20cycle%20parking%20facilities.pdf accessed 21.9.2016]

  – *London Cycling Design Standards: Chapter 8 Cycle Parking* (Transport for London 2014) [http://content.tfl.gov.uk/lcds-chapter8-cycleparking.pdf accessed 21.9.2016]

- **Special purpose bicycle parking guides**

  These guides are developed for specific audiences such as public transport authorities. For example:

  – *BART Bicycle Plan: Modeling Access to Transit* (Bay Area Rapid Transit 2012) [http://www.bart.gov/sites/default/files/docs/BART_Bike_Plan_Final_083012.pdf accessed 21.9.2016]

  – Bicycle Access and Parking Plan (Caltrain 2014) [http://www.caltrain.com/projectsplans/Plans/Bicycle_Access_and_Parking_Plan.html accessed 21.9.2016]

- **General Plans or general bicycle guidelines that include parking**

  For example:

  – *Miami Bicycle Master Plan* (City of Miami 2009) [http://miamigov.com/bicycleInitiatives/docs/20111012_Final_MBMP.pdf accessed 21.9.2016]

  – UK *Local Transport Note 2/08: Cycle Infrastructure Design* (Department for Transport 2008) [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/329150/ltn-2-08_Cycle_infrastructure_design.pdf accessed 21.9.2016]

  – *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005) [http://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/technical-manuals/nswbicyclev12aa_i.pdf accessed 21.9.2016]

- **Rules and regulations**

  For example:

  – *Bicycle Parking General Code: March 2008* (ACT Planning and Land Authority 2008) [http://www.legislation.act.gov.au/ni/2008-27/copy/56024/pdf/2008-27.pdf accessed 21.9.2016]

  – *Victorian Planning Provisions Clause 52.34 2004* [http://planningschemes.dpcd.vic.gov.au/schemes/vpps/52_34.pdf accessed 21.9.2016]

- **Handbooks produced by businesses**

  These documents combine sales catalogues with advice and guidance. For example:

  – Cycle Parking & Storage: Our approach to a changing world (Grontmij 2010) [http://www.grontmij.com/services/planning-and-design/Documents/Cycle%20Parking%20and%20Storage%20Brochure.pdf accessed 21.9.2016]

  – Securabike: Bicycle Parking Products, End of Trip Facilities (Leda 2016) [http://www.securabike.com.au/brochures accessed 21.9.2016]

  – Bicycle Parking Handbook (Bicycle Network 2004) [https://www.bicyclenetwork.com.au/media/vanilla_content/files/About%20Us/Media/Bike%20Parking%20Experts/Bicycle_Parking_Handbook.pdf accessed 21.9.2016]

- **Handbooks produced by rider groups**

  Groups representing the interests of riders publish documents that provide advice on successful parking. For example:

  – *Bicycle Parking Manual* (The Danish Cycling Federation 2008) [http://www.cycling-embassy.dk/2010/08/16/bicycle-parking-manual/ accessed 21.9.2016]

  – Bicycle Parking Solutions (Transportation Alternatives 2014) [https://www.transalt.org/sites/default/files/issues/bike/bikeparking.pdf accessed 21.9.2016]

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